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A New *Lyria* (Gastropoda: Volutidae) from Southeastern Madagascar

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ABSTRACT

Lyria patbaili new species is described based on crabbed shells taken in lobster pots off Fort-Dauphin, SE Madagascar, a region with cooler hydroclimatic conditions that demarcate it from the tropical conditions elsewhere in Madagascar. The new species differs from the two other species of *Lyria* living off Madagascar, *L. delessertiana* and *L. tulearensis*, by its much larger protoconch, narrower teleoconch, with fewer and lower axial ribs, less elaborate columellar and parietal plaiting, and a more complex color pattern.

Key words: Indian Ocean, Volutidae, endemism; cold water.

INTRODUCTION

Only two species of volutes (Gastropoda, Volutidae) are presently known from Madagascar, both belonging to the genus *Lyria* Gray, 1847, and both occupying very small ranges along the west coast of the island. *Lyria delessertiana* (Petit de la Saussaye, 1842) is restricted to the northwestern coast, with all accurately localized records originating from the island of Nosy Bé, while *Lyria tulearensis* Cosel & Blöcher, 1977 is restricted to the southwest, near Tuléar [= Toliara, Toliary]. A 1000 km latitudinal gap separates the ranges of these two forms, which Poppe & Goto (1992) treat as geographical subspecies. Apart from one doubtful and unconfirmed record of *Lyria lyraeformis* (Swainson, 1821) from near Tuléar (Poppe & Goto, 1992:72), no *Lyria* nor any other volute is known to occur on the coasts of Madagascar. The new species described here has been obtained in the region of Fort-Dauphin as a byproduct of lobster and crab fishing using baited traps. The shells of the three known specimens were probably occupied by hermit crabs. The soft parts are not known. The depth where the specimens were captured is not known precisely, but based on local fishing habits it is very likely to be less than 100 m, and probably between 30 and 50 m.

SYSTEMATICS

Class Gastropoda
Superfamily Volutoidea
Family Volutidae Rafinesque, 1815
Subfamily Lyriinae Pilsbry & Olsson, 1954
Genus *Lyria* Gray, 1847

Lyria patbaili new species
(Figures 1, 2)

Description: Shell large, fusiform, narrow, very solid and heavy, consisting of 2.0 protoconch and 5.75 teleoconch whorls (Figure 1). Protoconch (Figure 2) large, bulbous, apically depressed, with small slightly involuted nucleus, moderately convex whorls, with smooth, glossy surface, slightly appressed suture. Protoconch/teleoconch transition sharp. Teleoconch whorls moderately convex, with shallow suture. Sculpture consisting of strong, low, orthocline axial ribs, distinctly sigmoid on last adult whorl, discrete, narrow spiral groves in rib interspaces. Sixteen axial ribs on first teleoconch whorls, increasing to 19 on penultimate whorl, 20 on last whorl, interspaces as broad as ribs. Thick labial varix behind peristome. About 10 spiral groves on first teleoconch whorl, 15 on third whorl, more crowded in subsutural zone, becoming more obsolete on penultimate and last whorls. Four stronger, raised cords at base of last whorl. Aperture ovate, narrow, forming a narrow angle adapically, outer lip smooth, inner lip forming a distinct callus over body whorl, expanded, moderately raised over columella; 9 plaits in columellar region, stronger abapically, 3 indistinct wrinkles in parietal region. Siphonal canal broad, short, open. Protoconch violet pink. Teleoconch ground colour pinkish salmon with complex pattern of spiral lines and blotches. Spiral lines brown, interrupted in interspaces between ribs, four on spire whorls, nine on last whorl, evenly spaced, delimiting a subsutural band twice as broad as distance between lines; brown blotches occupying two spiral bands, the broad subsutural band and a narrow band, situated abapically of exposed part of spire whorls and on periphery of last whorl. Siphonal band and edge of siphonal canal with axially elongated brown violet stripes. Aperture creamy salmon.

Type material: Holotype in MNHN. Paratype in the collection of Mr Harald Douté (Bad Säckingen, Germany).

Type locality: Region of Fort-Dauphin [= Taolanaro], southern Madagascar (ca. 25°01′ S, 47°00′ E), from fishermen.

Dimensions: Length 72.0 mm, width 26.0 mm, aperture length 37.0 mm.

Remarks: The paratype shares the characters of the holotype, but is proportionally narrower, with a shorter aperture (length 65.5 mm, width 21.0 mm, aperture length 28.0 mm), and has three, rather than four, brown spiral lines on spire whorls, and eight on last whorl. *Lyr*

Figure 1. *Lyria patbaili* new species Holotype MNHN. [illegible] mm.

[illegible]rs from the two other species of *Lyria* [illegible] scar, *L. delessertiana* and *L. tulear-* [illegible]rger protoconch, its narrower teleo- [illegible]nd lower axial ribs, less elaborate col[illegible]d plaiting, and a more complex col- or[illegible]*rmis* is also a rather slender spe- cies. [illegible]lour pattern resembles that of *L. patb*[illegible]iral bands occupied by brown reddish [illegible]s an even larger protoconch with cal[illegible]ermination, more convex te- leoconch wi[illegible]rous brown spiral lines.

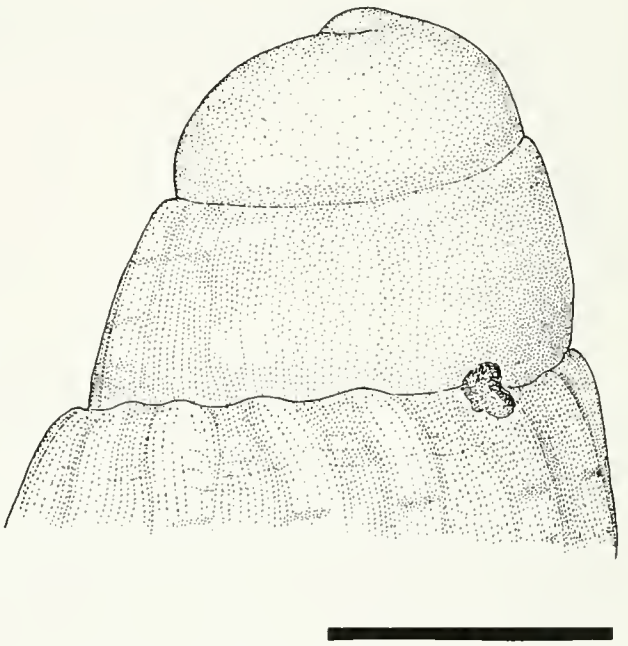

Figure 2. *Lyria patbaili* new species. Protoconch of paratype, length 65.5 mm, Douté collection. Scale line = 5 mm.

Etymology: The specific name honors Dr. Patrice Bail, volute collector and expert, and president of Association Française de Conchyliologie. Dr. Bail very generously donated the holotype to MNHN.

Distributional and biogeographical remarks: The size and morphology of its protoconch suggest that *Lyria patbaili,* like many other volutes, has non-planktotrophic development with intracapsular metamorphosis and hatches as a crawling juvenile.

The region of Fort-Dauphin is characterized in Madagascar by its spectacular belts of brown macrophytes, ressembling the algal belts of temperate coasts (A. Crosnier, pers. com.); there are no coral reefs in the area. Published satellite data on winter sea surface temperatures (Piton & Laroche, 1993) confirm a local anomaly, with temperatures as low as 21.5°C, vs 24–25°C or more elsewhere around Madagascar. Although the total range of *Lyria patbaili* is not known, it is tempting to associate the local hydroclimatic conditions with the narrow distribution of certain marine biota. Similarly, *Palinurus delagoae* Barnard, 1926, a commercial species of lobster (Crustacea: Palinuridae) has a range in Madagascar restricted to near Fort-Dauphin, and otherwise extends from Mozambique to Natal (Holthuis, 1984).

With the addition of *Lyria patbaili,* five species of *Lyria* are now known from the SW Indian Ocean (Figure 3) and a further two from Saya de Malha Bank (Bouchet & Bail, 1991). This distribution pattern is coherent with the scenario hypothesized by Bouchet & Bail (1991), who suggested that colonization by lecithotrophic larvae, although a rare dispersal event, is responsible for the existence of morphologically segregate, allopatric species.

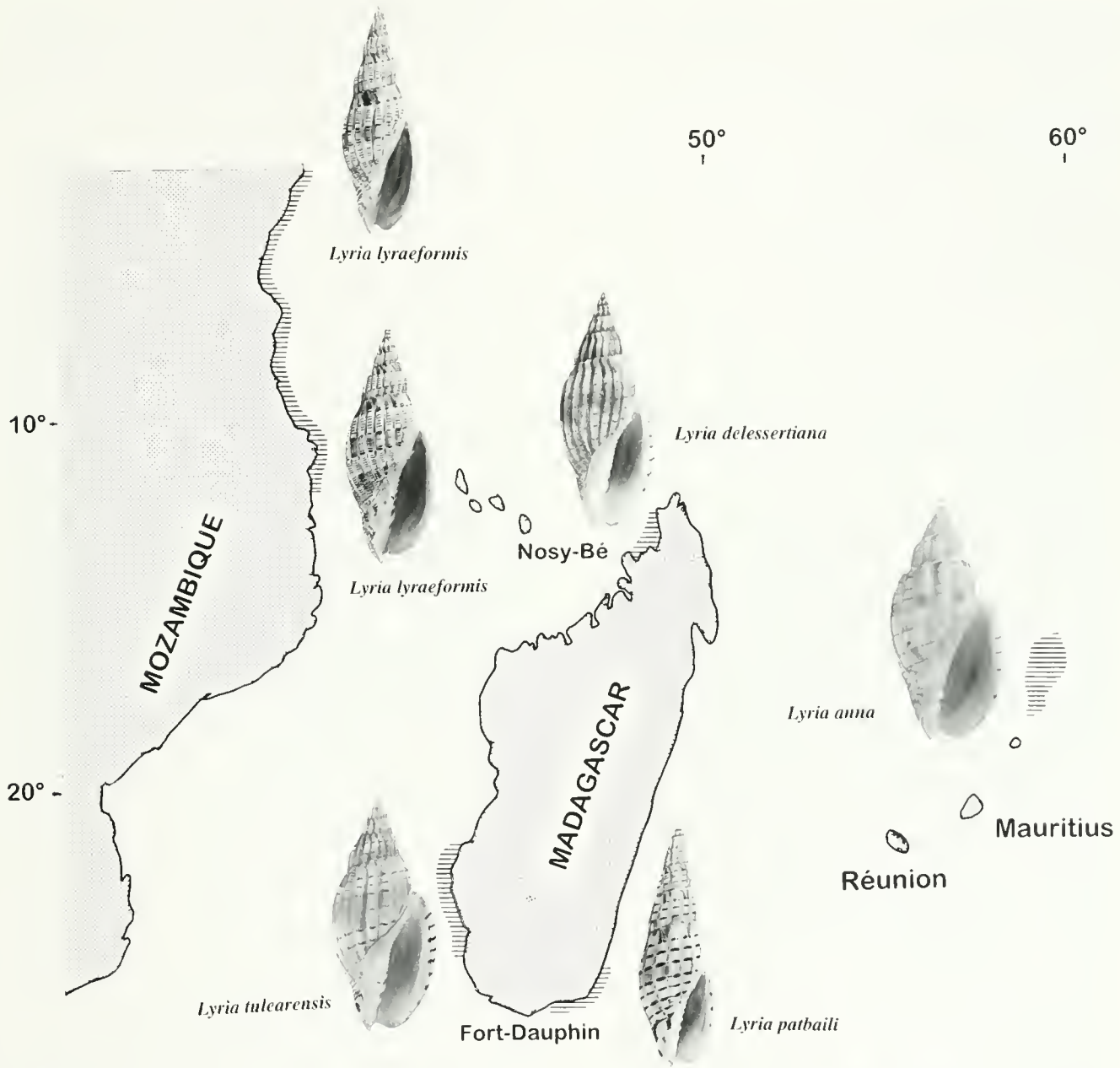

Figure 3. Generalized distributions (hatched areas) of the 5 species of *Lyria* occurring in the SW Indian Ocean. Paratype of *L. patbaili* illustrated. Distribution data from Weaver & duPont (1970) and Poppe & Goto (1992); however, Weaver & duPont (1970: 18) give the range of *L. delessertiana* as extending to the Comoro Islands and the southern Seychelles, and Poppe & Goto (1992: 65) record the range as extending to Diego Suarez [= Antseranana] but this needs confirmation. Two forms of *Lyria lyraeformis* are illustrated, the broad form occurs in all the species range from Mozambique to Somalia, the slender form occurs predominantly in the central part of its range, i.e. Kenya (Bail, pers. com.).

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A Revision of the Recent Solariellinae (Gastropoda: Trochoidea) of the New Zealand Region

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ABSTRACT

Twenty-nine species (17 new) of Solariellinae are recorded from the Norfolk Ridge, Three Kings Rise, Kermadec Ridge, and New Zealand. The species are referred to *Solariella* Wood, 1842 (10 species, 4 of which are new), *Bathymophila* Dall, 1881 (3 new), *Microgaza* Dall, 1881 (1 new), *Archiminolia* Iredale, 1929 (10, 6 new), and *Zetela* Finlay, 1926 (5, 3 new). *Zeminolia* Finlay, 1926, is treated as a synonym of *Solariella*. *Bathymophila* Dall, 1881, is transferred from Margaritinae to Solariellinae on the basis of radular morphology. *Ethaliopsis* Schepman, 1908, is synonymized with *Bathymophila*, the shell of a paralectotype of *Solariella* (*Ethaliopsis*) *callomphala* Schepman, 1908, is illustrated, and a lectotype is designated for the species. *Lamellitrochus* Quinn, 1991, (based on a western Atlantic species) is regarded as a probable synonym of *Zetela*, and the southern African species *Solariella intermissa* Thiele, 1925, and the North Atlantic species *Trochus* (*Margarita*) *rhina* Watson, 1886 (= *Solariella cincta* sensu Dautzenberg and Fischer, 1896, and Dautzenberg, 1927, not Philippi, 1836) are referred to *Zetela*. Sexually dimorphic shell morphology in New Zealand *Solariella* species is discussed.

Key words: Trochidae, Solariellinae, new taxa, New Zealand, Kermadec Ridge, Norfolk Ridge, North Atlantic, western Atlantic, southern Africa.

INTRODUCTION

The trochid subfamily Solariellinae has a cosmopolitan distribution, sublittoral to abyssal depths. Solariellines are deposit feeders and most if not all of them are proficient scavengers. Species examined alive are capable of [illegible] moving the foot from side to side, evidently response (Herbert, 1987). Although several species are consistently collected alive from rugged substrata with bryozoans, sponges, hydroids, and [illegible] that they live and feed in the surrounding sediments rather than in association with other [illegible] of the New Zealand species have exceptionally large [illegible] for sediment dwellers, suggesting [illegible] physiological requirements. The sexes are separate and some species brood within the pallial cavity or the umbilicus. Whereas shell morphology is frequently little different from that in Margaritinae and Umboniinae and is interspecifically variable, the animal is distinctive in having tentaculiform processes on the snout and a short, broad radula with a low number of rows (ca. 20) of teeth; few, simple marginal teeth (6–10 pairs); and distinctive central and lateral tooth morphology. The central and inner three pairs of laterals are short and stout with angulate cutting areas (lateral 3 may have a reduced cutting area), and lateral 4 is elongate, curved, and typically lacks secondary cusps. Many species are further characterized by having the innermost pair of marginal teeth transformed during ontogenesis into broad lateromarginal plates.

Abbreviations and text conventions:

AIM	Auckland Institute and Museum
AMS	Australian Museum, Sydney
cf.	compare (with)
BMNH	The Natural History Museum, London
NMNZ	Museum of New Zealand Te Papa Tongarewa, Wellington
NZOI	National Institute of Water and Atmospheric Research, Wellington
TW	(number of) teleoconch whorls
USNM	National Museum of Natural History, Washington, D.C.
ZMA	Zoological Museum, Amsterdam

In all measurements of shells, length precedes width. Unless specified, all material was collected as dead shells and is deposited at NMNZ.

SYSTEMATICS

Superfamily Trochoidea Rafinesque, 1815
Family Trochidae Rafinesque, 1815
Subfamily Solariellinae Powell, 1951
Solariellinae Powell, 1951: 102—nominotypical genus *Solariella* Wood, 1842.
Talopiidae Finlay, 1928: 238—nominotypical genus *Talopia* Gray, 1842 (in part).
Minoliinae Kuroda, Habe, and Oyama, 1971: 26—nominotypical genus *Minolia* A. Adams, 1860.

Remarks: Interpretation of groups of solarielline genera has been complicated by the fact that the type species of *Solariella* (*S. maculata* Wood, 1842) is a Pliocene fossil and because some Recent species that resemble it have adult radulae with lateromarginal plates, whereas other species lack them. One Recent species that bears a particularly close resemblance to *S. maculata* (Herbert, 1997, fig. 204–206) is *S. cincta* (Philippi, 1836) (Warén, 1993, fig. 2E, as *S. inoptanda* Locard, 1897 = *S. cincta*), the adult radula of which lacks lateromarginal plates (F. Rubio, pers. comm.). Another similar European species is *Solariella amabilis* (Jeffreys, 1865) (figure 40), the adult radula of which has broad lateromarginal plates (Warén, 1993, fig. 7B). *Solariella amabilis* (= *Trochus affinis* Friele, 1877) is the type species of *Machaeroplax*, which has generally been interpreted as a synonym of *Solariella* (Odhner, 1912; Thiele, 1929; Marshall, 1979; Quinn, 1979; Hickman and McLean, 1990; Warén, 1993; herein), although Herbert (1987) was more cautious in his approach.

Warén (1990) has shown that solarielline lateromarginal plates appear during radular ontogenesis. He was unable to ascertain their origin, but it seems likely that they arise by progressive in-column transformation of existing teeth such as the innermost pair of marginals rather than by intercalation (which among Trochoidea is known to occur only in calliostomatids). Whatever their origin, presence or absence in adults of lateromarginal plates, or degree of transformation of the teeth from which they apparently develop, cannot be used alone for separation of genera or subgenera, since radular ontogenesis will naturally be accelerated or retarded to varying degrees from species to species. Whereas lateromarginal plate morphology in adults is infraspecifically stable in all species examined, interspecifically the lateromarginal plate may be broad, short and bar-like, or the innermost marginals may be shortened with the cutting area weakened to varying degrees. These considerations led Warén (1993) to include the North Atlantic species *Solariella obscura* (Couthouy, 1838) and *S. varicosa* (Mighels and Adams, 1842) (Warén, 1993, fig. 4A, B, 6A–C) in *Solariella* together with *S. amabilis*, which they resemble in external anatomy but lack lateromarginal plates. Species with broad lateromarginal plates include the type species of *Microgaza* Dall, 1881, *Spectamen* Iredale, 1924 (? = *Solariella*), *Zeminolia* Finlay, 1926 (= *Solariella*), *Minolops* Iredale, 1929 (? = *Spectamen*), and *Archiminolia* Iredale, 1929. Species with shortened or otherwise modified innermost marginal teeth include most species herein referred to *Zetela* Finlay, 1926, *Bathymophila* Dall, 1881 (Warén, 1990, p. 180; figures 130, 131 herein), and the type species of *Suavotrochus* Dall, 1924, *Hazuregyra* Shikama, 1962 (A. Warén, pers. comm.), and *Lamellitrochus* Quinn, 1991 (? = *Zetela*). The type species of *Zetela*, species of *Ilanga* Herbert, 1987, and *Solariella varicosa* and *S. obscura* have unmodified innermost marginal teeth.

Herbert (1987) provided evidence to suggest that local phylogenetic radiations (notably *Ilanga* off southern Africa) are recognizable from features of both radular and epipodial morphology. Epipodial features include number and relative size of the epipodial tentacles, presence or absence of flap-like projections (here termed epipodial lobes) from the epipodial fringe, and number of neck lobes. From observations of living specimens, Herbert (1987) recorded southern African species as having a tiny right postoptic tentacle, although I was unable to detect such a structure in any solariellines recorded herein (preserved material). Herbert (1987, p. 295) reported the existence of *Ilanga* species with four pairs of large epipodial tentacles in adults and three pairs in juveniles, which indicates that the number may increase during ontogenesis. One group (*Zetela*) is distinctive in having four pairs of epipodial tentacles, the two middle pairs of which are typically much smaller than the others. Many other species (e. g., of *Solariella sensu stricto* and *Spectamen*) have three pairs of epipodial tentacles and a prominent epipodial lobe on each side between the anterior pairs of tentacles. Judging from the fact that epipodial lobes have epipodial sense organs at their bases (Herbert, 1987, fig. 118), they would seem to be modified epipodial tentacles, which in turn suggests that four pairs of tentacles is plesiomorphic. Whether or not arrested development and/or transformation of epipodial tentacles occurs during ontogenesis remains to be established. These considerations, together with the existence in *Archiminolia oleacea* (Hedley and Petterd, 1906) of three right and four left epipodial tentacles and of three pairs in *A. meridiana* (Dell, 1953), both of which have very similar shells and radular morphologies, suggest that the number of epipodial tentacles has somewhat limited value for supraspecific grouping.

Solarielline shell sculpture may be predominantly spiral or axial, or it may be reticulate. Most species have rather stable shell sculpture, though *Solariella obscura* is exceedingly variable, ranging from strongly reticulately sculptured to almost smooth (Warén, 1993). Whereas many species are strongly sculptured throughout, others become more or less smooth following an initial spirally sculptured stage. The latter include the type species of *Microgaza*, *Bathymophila*, *Archiminolia*, and *Ilanga*. The type species of *Suavotrochus* is essentially smooth throughout. Species of *Bathymophila* are distinctive in that the umbilicus is covered by a thick callus with a granulate surface (produced by an internal layer of minute calcareous spheres). There is strong convergence in shell shape and sculpture in the group. For example

Ilanga biradiatula (Martens, 1902) and *I. laevissima* (Martens, 1881) (Herbert, 1987) resemble species of *Archiminolia* without umbilical septa in shell morphology, whereas *I. discus* Herbert, 1987, resembles the type species of *Microgaza*, yet they differ in radular morphology and external anatomy (unknown in *Microgaza*). Although solariellines (or at least solarielline-like species) have been recorded from as early as the Late Cretaceous (Hickman and McLean, 1990) and undoubted solariellines are known from the Eocene (Maxwell, 1992), the fossil record of the group is poor, and there are no documented lineages. Since it is thus impossible to establish character-state polarity, it seems likely that species in which the teleoconch becomes more or less smooth are derived from species with stronger, more persistent sculpture. Loss of sculpture, which presumably enhances sediment penetration, has probably occurred repeatedly in the group, almost certainly independently in *Solariella obscura*, *Microgaza/Bathymophila/Archiminolia*, *Ilanga*, and *Suavotrochus*, and quite possibly independently in *Microgaza*, *Bathymophila*, and *Archiminolia* as well. Influenced by the fact that most species with lateromarginal plates (apomorphic) have three pairs of epipodial tentacles (apomorphic), whereas those without lateromarginal plates have four pairs of epipodial tentacles (both plesiomorphic), I consider the prime candidate for a basal solarielline group to be *Zetela*, all species of which have strong spiral and (especially) axial sculpture. *Zetela* species are strikingly similar to species of *Calliotropis* Seguenza, 1903 (Eucyclinae), and, indeed, there are some similarities in external anatomy and radular morphology, the implication being that the groups have a common origin.

In the absence of any firm evidence for degree of relatedness, I have avoided the use subgenera or to lump heavily, and I interpret *Solariella*, *Microgaza*, *Bathymophila*, *Suavotrochus*, *Zetela*, *Archiminolia*, *Hazuregyra*, and *Ilanga* as distinct genera. *Solariella* apparently has a worldwide distribution, *Microgaza* western Atlantic and western Pacific, *Bathymophila* Atlantic and western Pacific, *Suavotrochus* western Atlantic, *Zetela* worldwide, *Archiminolia* western Pacific and possibly Indian Ocean, *Hazuregyra* northwestern Pacific, and *Ilanga* Indian Ocean and possibly western Pacific.

Higher classification follows Hickman and McLean (1990).

Genus *Solariella* Wood, 1842

Wood, 1842: 531. Type species (by monotypy): *Solariella* Wood, 1842; Pliocene, England.

de, 1877: 311. Type species (by subsequent Tr on, 1889): *Trochus affinis* Friele, 1877 Jeffreys, 1865; Recent, western Eu-

182, 227. Type species (by original *philippensis* Watson, 1880; Recent,

Zeminol Type species (by original designation): *Minolia plicatula* Murdoch and Suter, 1906; Recent, northern New Zealand.

?*Minolops* Iredale, 1929: 169. Type species (by original designation): *Minolia pulcherrima emendata* [sic—*emendata* treated as a full species on the same page by Iredale, 1929] Iredale, 1924; Recent, New South Wales.

Remarks: The animal of *Solariella amabilis* (preserved material, North Sea, 292–340 m, pers. obs.) has a broad right neck lobe, two smaller left neck lobes, three pairs of long, tapered epipodial tentacles, and a broad epipodial lobe between the two anterior tentacles on each side. The animal is essentially similar to those of *S. obscura* and *S. varicosa* (Warén, 1993, fig. 4A, B). The animal and radula (Warén, 1993, fig. 7B) are very similar to those of *Zeminolia plicatula* (preserved material, pers. obs.) and southern African *Spectamen* species (Herbert, 1987, fig. 118; NB "hl" and rnl" are transposed in all illustrations of animals in this paper). Unfortunately the external anatomies of the type species of *Spectamen* and *Minolops* remain unknown (all available animals dry). Whereas all of the southern species of *Solariella* have lateromarginal plates, they may be present or absent in North Atlantic species (see above).

Spectamen philippensis and *Zeminolia plicatula* (figures 1–4) differ principally from *S. maculata*, *S. amabilis* (figure 40), and *S. cincta* in having much weaker axial sculpture on the teleoconch. *Zeminolia plicatula* differs further by having by having a wider umbilicus, a lower spire, sexually dimorphic shells, and by brooding its young within the umbilicus. Among New Zealand taxa here referred to *Solariella sensu stricto*, however, there is rather fluid interspecific gradation between the extremes in umbilical morphology, spire length, and sculpture (figures 1–12, 15–39, 41–47). In the apparent absence of any combination of character states by which *Solariella* and *Zeminolia* may be distinguished, it seems that *Zeminolia* should be treated as a synonym of *Solariella*. All of the New Zealand species of *Solariella* have a calcified periostracum (intritacalx), as in *Lamellitrochus* (Quinn, 1991), which is probably a synonym of *Zetela* (see below).

The type species of *Minolops* has unusually strong, crowded axial riblets on the teleoconch and is also distinctive in having fine axial sculpture on the outer part of the first half whorl of the protoconch (Herbert, 1987, fig. 214). The axial sculpture on the protoconch of *Minolops emendata* is evidently teleoconch sculpture that has been predisplaced into the larval stage by a heterochronic process.

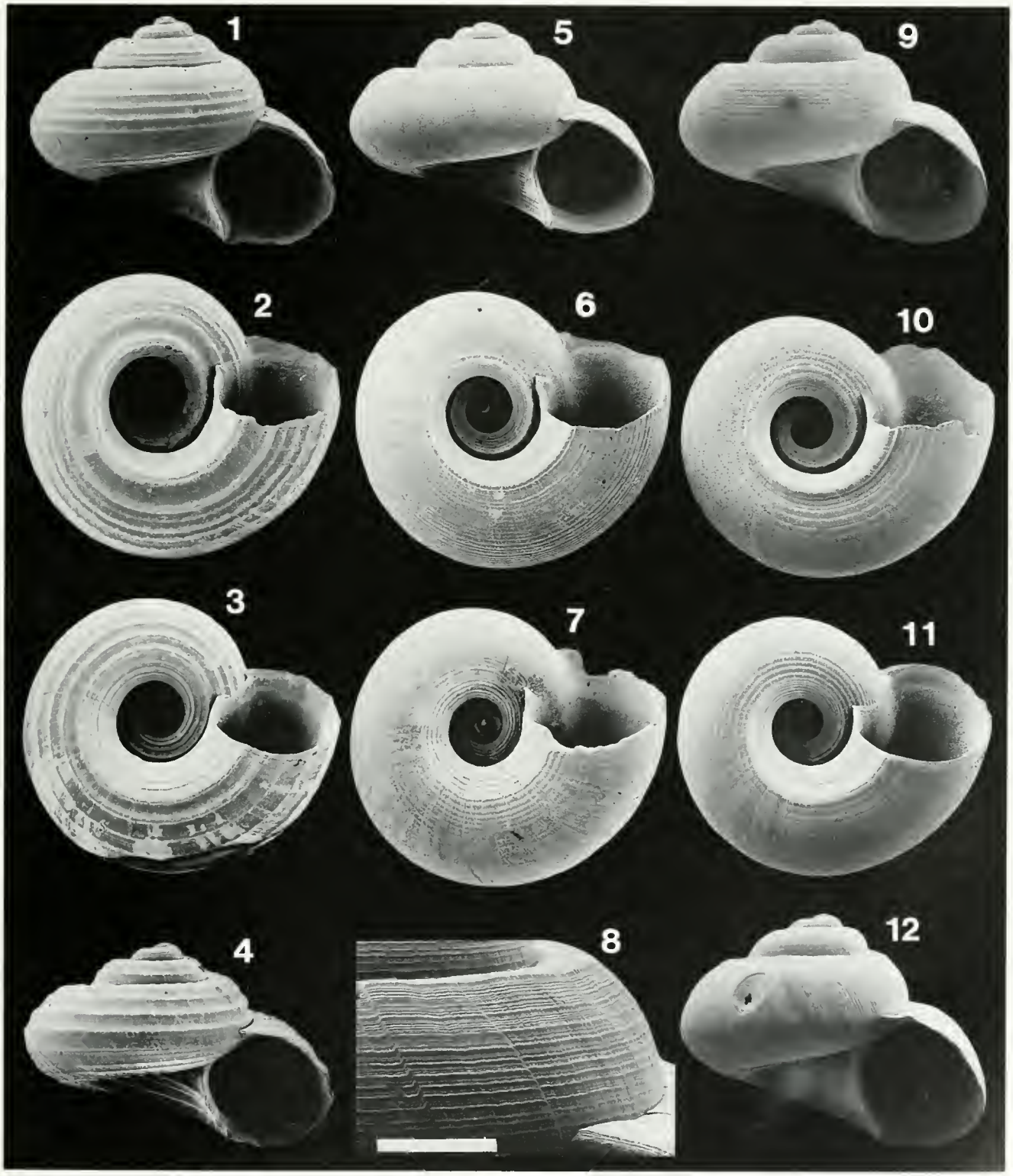
Solariella plicatula (Murdoch and Suter, 1906)
(Figures 1–4, 13, 18, 41, 125)

Minolia plicatula Murdoch and Suter, 1906: 299, pl. 26, fig. 47–49.

Monilea (Minolia) plicatula.—Suter, 1913: 142, pl. 33, fig. 12.

Zeminolia plicatula.—Finlay, 1926: 359; Keen, 1960: 262, fig. 167/2; Herbert, 1987: fig. 215, 216.

Isanda (Zeminolia) plicatula.—Wenz, 1938: 318, fig. 719.



Figures 1–12. Shells of species of *Solariella* **1–4.** *S. plicatula* (Murdoch and Suter), Rangaunu Bay, 63 m, M.130750. **1, 2.** Females (1, 4.00 × 5.50 mm; 2, 4.00 × 5.65 mm). **3, 4.** Males (3, 2.85 × 4.45 mm; 4, 2.95 × 4.55 mm). **5–7.** *S. vera* (Powell) **5.** Female, Middlesex Bank, 186–196 m, M.130064 (4.25 × 6.40 mm). **6.** Female, E of Great Island, 100 m, M.130065 (4.20 × 6.10 mm). **7.** Male, NE of Great Island, Three Kings Islands, 550 m, M.130062 (3.05 × 4.45 mm). **8–12.** *S. luteola* (Powell). 8, **9.** Female, off Northeast Island, Three Kings Islands, 102 m, M.34254 (2.90 × 4.40 mm). **10.** Female, Middlesex Bank, 98–103 m, M.130051 (3.30 × 5.00 mm). **11.** Male, Middlesex bank, 98–103 m, M.130051 (3.00 × 4.70 mm). **12.** SW of Great Island, 440 m, M.130045 (3.45 × 4.90 mm). Scale = 250 μm.

Spectamen plicatulum.—Powell, 1976: 84; Powell, 1979: 64, pl. 17, fig. 19.

Spectamen verum.—Powell, 1979: 64 (remarks on *Spectamen* only); Hayward and Grace, 1981: text fig. 3; Hickman, 1992: 254. Not Powell, 1937.

Type material: Holotype NMNZ M.1124, from type locality, 22 January 1904, S.S. *Awarua*.

Type locality: Off Great Barrier Island, 36°08′S, 175°55′E, 201 m.

Other material examined (> 1000 specimens): N of North Cape, 34°20.0′S, 173°06.6′E, collected alive, 163–168 m, 27 January 1981, R/V *Tangaroa* (12, M.130088); off North Cape, 91 m, J.A. Bollons (2, M.2167); E of North Cape, 34°25.0′S, 173°13.1′E, 327–257 m, 27 January 1981, R/V *Tangaroa* (21, M.130086); Great Exhibition Bay, 34°33.4′S, 173°04.8′E, collected alive, 63 m, 27 January 1981, R/V *Tangaroa* (many, M.113347); Great Exhibition Bay, 34°33.6′S, 173°04.9′E, collected alive, 66 m, 27 January 1981, R/V *Tangaroa* (19, M.130067); SW of Cape Maria van Diemen, 34°41.9′S, 172°33.9′E, 103 m, 10 January 1981, R/V *Tangaroa* (2, M.131499); SW of Cape Maria van Diemen, 34°41.9′S, 172°33.5′E, 103 m, 10 January 1981, R/V *Tangaroa* (2, M.130087); off Cone Point, N of Whangaroa, collected alive, 44 m, September 1965, M.V. *Ikatere* (3, M.64330); NW of Whangaroa Harbour, 34°54.0′S, 173°42.6′E, 83 m, 26 January 1981, R/V *Tangaroa* (many, M.130767); off Flat Island, Whangaroa, 66 m, September 1965, M.V. *Ikatere* (1, M.64472); off Cape Brett, 35°08′S, 174°12.5′E, 80 m, 16 February 1974, R/V *Acheron* (25, M.35780); NE of Ninepin Rock, Bay of Islands, 35°08.8′S, 174°10.3′E, collected alive, 75 m, 1 December 1971, M.V. *Kokinga* (6, M.30767); between Redhead and Ninepin Rock and out, Bay of Islands, 35°09′S, 174°09′E, 46–51 m, 13 December 1973, M.V. *Kokinga* (1, M.40758); off Takau Bay, 35°10′S, 174°11′E, collected alive, 80 m, 16 February 1974, R/V *Acheron* (9, M.43652); off Ahipara, 35°10.4′S, 172°35.4′E, collected alive, 233 m, 11 January 1981, R/V *Tangaroa* (4, M.130089); off Takau Bay, 35°10.5′S, 174°10′E, 37 m, 16 February 1974, R/V *Acheron* (7, M.43501); Bay of Islands, 35°10.6′S, 174°15.4′E, 67–73 m, 12 February 1976, M.V. *Kokinga* (4, M.96005); Bay of Islands, 35°11.2′S, 174°16.7′E, collected alive, 58–64 m, 11 February 1976, M.V. *Kokinga* (18, M.96143); Deep Water Cove, Bay of Islands, 35°11.6′S, 174°18.1′E, collected alive, 23–32 m, 10 February 1976, M.V. *Kokinga* (many, M.95538); Bay of Islands, 35°11.6′S, 174°16.5′E, 54 m, 11 February 1976, M.V. *Kokinga* (18, M.95910); off island at entrance to Deep Water Cove, 35°11.9′S, [illegible]′E, collected alive, 47–49m, 11 February 1976, [illegible]12, M.95720); between Hope Passage and [illegible] 35°12′S, 174°18′E, 37–40 m, 10 December [illegible] M.V. *Kokinga* (1, M.41454); Deepwater [illegible]12′S, 174°18′E, 33–46 m, 6 December [illegible] M.41499); between Hope Passage [illegible] f Islands, 35°12′S, 174°18′E, 37 m, [illegible] M.V. *Kokinga* (1, M.41401); between [illegible]land and Moturoa, Bay of Islands, 35°12′S, 174°06′E, collected alive, 31 m, 13 December 1973, M.V. *Kokinga* (5, M.41630); Bay of Islands, 35°12.5′S, 174°16.1′E, 40 m, 11 February 1976, M.V. *Kokinga* (2, M.95642); N of Poor Knights Islands, 35°22′S, 174°43′E, collected alive, 146 m, 15 February 1974, R/V *Acheron* (many, M.35115); W of Poor Knights Islands, 35°29′S, 174°43.5′E, collected alive, 110 m, 15 February 1974, R/V *Acheron* (18, M.35229); W of Poor Knights Islands, 35°32′S, 174°41′E, collected alive, 121–113 m, 15 February 1974, R/V *Acheron* (24, M.35876); off Poor Knights Islands, 79 m, March 1971 (3, M.44715); off Poor Knights Islands, 124 m, September 1965, M.V. *Ikatere* (6, M.39638); off Hen Island, 36°00.5′S, 174°43′E, 59 m, 13 February 1974, R/V *Acheron* (6, M.43809); off Hen Island, 48–55 m, J.A. Bollons (4, M.7242); off Tryphena, Great Barrier Island (1, M.91031); off Cuvier Island, 64 m and 70 m, J.A. Bollons (2, M.2165; 4, M.7241); 5 km E of Channel Island, Cape Colville, 137 m (1, M.2164); off Aldermen Islands, 165 m, 10 June 1970, B.L. Godfriaux (3, M.44386); off Aldermen Islands, 146 m, 26 May 1969, B.L. Godfriaux (3, M.44419); N of Aldermen Islands, 36°47.5′S, 176°00.0′E, 108–113 m, 24 January 1981, R/V *Tangaroa* (1, M.130068); SE of Aldermen Islands, 37°00.8′S, 176°12.3′E, collected alive, 178–248 m, 23 January 1979, R/V *Tangaroa* (many, M.65151); N of Mayor Island, 37°15.2′S, 176°14.5′E, 188–193 m, 22 January 1979, R/V *Tangaroa* (1, M.60979); off Mayor Island, 37°16.7′S, 176°17.5′E, 104–109 m, 22 January 1979, R/V *Tangaroa* (5, M.67411); off E side of Mayor Island, 37°18.9′S, 176°16.2′E, 59–74 m, 22 January 1979, R/V *Tangaroa* (5, M.65680); off Mayor Island, 37°22.5′S, 176°22′E, 207–220 m, 27 February 1957, M.V. *Alert* (1, M.12887); off SE side Mayor Island, 37–91 m, February 1986, G. Nicholson (1, M.92093); off White Island, 37°30.4′S, 177°09.7′E, collected alive, 83–92 m, 19 January 1979, R/V *Tangaroa* (4, M.130070); Rungapapa Knoll, WNW of White Island, 37°33.8′S, 176°59.0′E, 188–228 m, 20 January 1979, R/V *Tangaroa* (1, M.113498); W of Plate Island, 37°39.1′S, 176°31.5′E, 64–59m, 21 January 1979, R/V *Tangaroa* (2, M.67638); between Motuhora and White islands, 37°40.2′S, 178°53.6′E, collected alive, 117 m, 2 May 1990, R/V *Akademik Alexander Nesmeyanov* (3, M.112438); N of New Plymouth, 38°40.2′S, 174°03.9′E, collected alive, 88 m, 13 January 1981, R/V *Tangaroa* (1, M.130069); N of New Plymouth, 38°40.4′S, 174°04.0′E, collected alive, 88 m, 13 January 1981, R/V *Tangaroa* (1, M.130093); N of New Plymouth, 38°55.0′S, 174°09.3′E, 48 m, 13 January 1981, R/V *Tangaroa* (4, M.130066).

Distribution (Figures 13, 48): Northern North Island: west coast from Ahipara to New Plymouth, east coast from North Cape to White Island, 31–257 m; collected alive at 31–ca. 248 m from sand and mud.

Remarks: Among New Zealand *Solariella* species, *S. plicatula* is distinctive in the combination of low spire, wide umbilicus, strong spiral cords on spire and base, and the color pattern of dull red sigmoidal bands on the spire and base. The intritacalx of this species resolves as

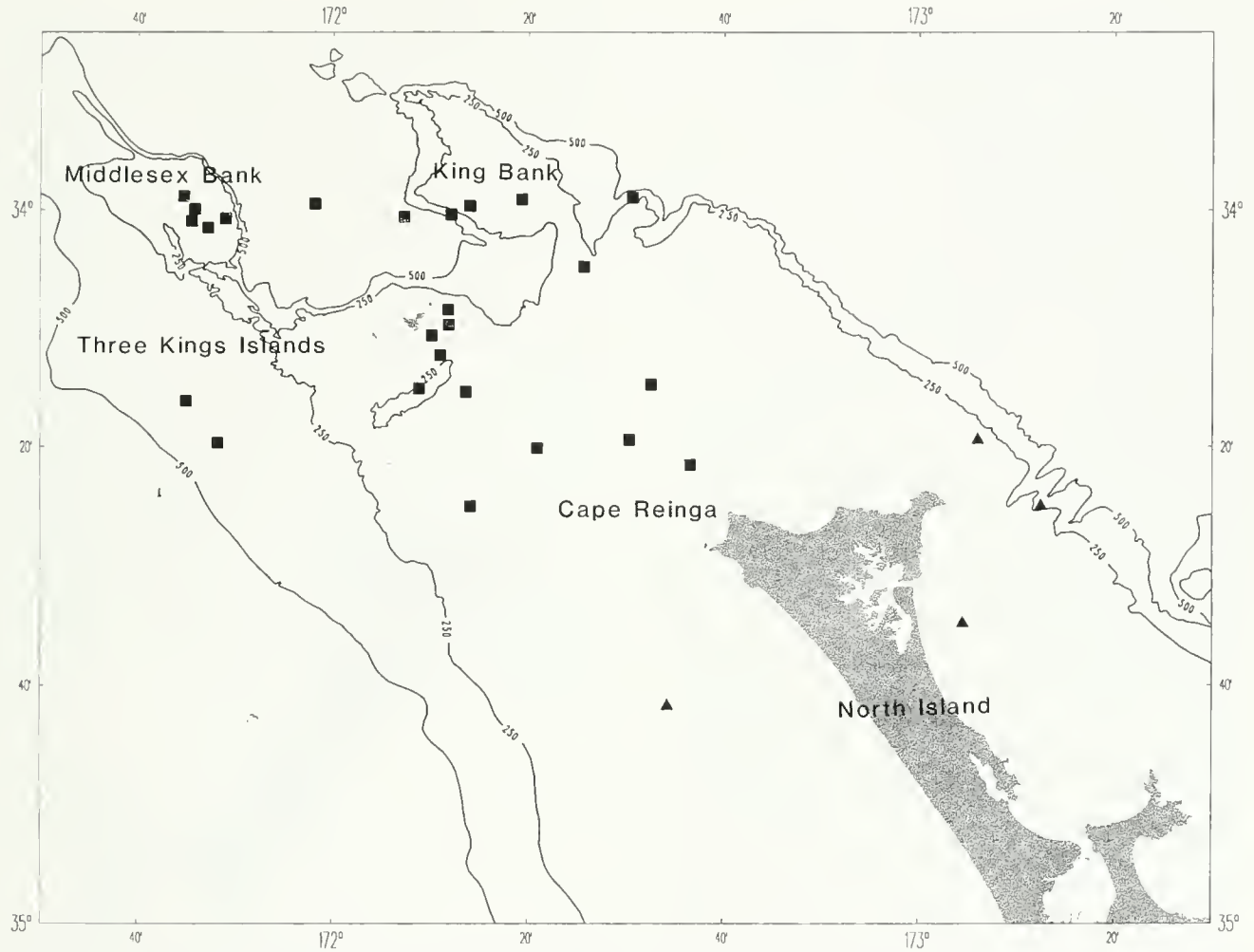


Figure 13. Map of Three Kings Islands and northern tip of North Island, New Zealand showing distributions of species of *Solariella* (250 and 500 m isobaths indicated): *S. plicatula* (Murdoch and Suter) (▲) and *S. lutcola* (Powell) (■).

conspicuous, axial lines when the shell is (naturally) lightly solution-etched (figure 3).

Solariella plicatula is an umbilical brooder, specimens more than 2.5 mm wide having pronounced sexual dimorphism in shell size, shape and umbilicus morphology (figures 1–4). With increasing shell size, the umbilical rim in females becomes strongly angulate instead of remaining weakly angulate or evenly rounded as in males, the spiral thread at the umbilical rim becomes stronger and higher, the umbilical wall becomes steeper and more weakly sculptured or essentially smooth, the shell becomes slightly higher relative to its width, and the umbilicus may become *narrower* than in some males, though the volume (not measured) is greater because of the steeper wall and the produced rim: shell/umbilicus width ratio 1.70–2.30, mean = 2.08 (SD = 0.161, n = 20) in females, and 1.70–2.40, mean = 2.03 (SD = 0.190, n = 20) in males. Females also attain larger size than males (largest seen 7.00 mm wide, as against 5.50 mm). Note that in the boreal Pacific species *Margarites vorticiferus* (Dall, 1873), the only known trochid umbilical brooder other than the present *Solariella* species, the umbilicus is both wider and more voluminous in females than in males (Lindberg and Dobberteen, 1981; Lindberg, 1985). Dobberteen and Ellmore (1986) found that shell dimorphism in *Margarites vorticiferus* is expressed even at the embryonic stage, and although shell dimorphism is not obvious in specimens of *S. plicatula* less than 2.5 mm wide, it remains to be checked.

In a sample of 240 specimens more than 2.5 mm wide taken off Rangaunu Bay at 63 m depth (NMNZ M.130750), the female: male ratio is 1.12:1. Specimens with yolky egg capsules (8 or 10) within the umbilicus were obtained during the months of December, January (M.65151, M.130067), and May (Hayward and Grace, 1981 - misidentified as *S. vera*), and shelled larvae occurred during December and February (M.35115, M.41401).

The radula (figure 125) is typical of the genus, with broad lateromarginal plates. The jaw plates are extremely thin, with very weak elements along the leading edge only.

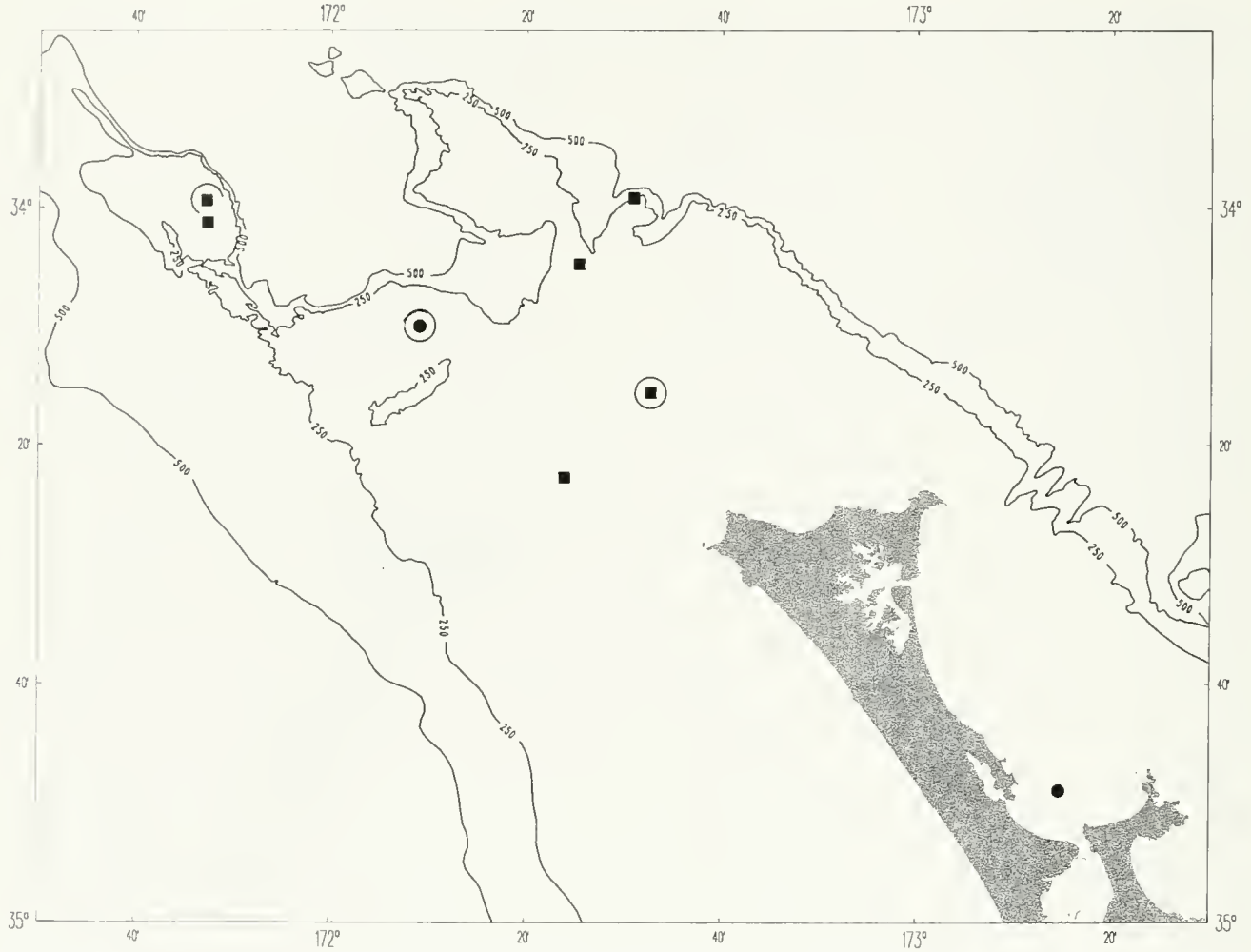


Figure 14. Map of Three Kings Islands and northern tip of North Island, New Zealand showing distributions of species of *Solariella* (250 and 500 m isobaths indicated): *S. vera* (Powell) (■), *S. exigua* new species (●) and *S. basilica* new species (○).

Solariella vera (Powell, 1937)
(Figures 5–7, 14, 42, 126)

Zeminolia vera Powell, 1937: 179, pl. 51, fig. 3
Spectamen verum.—Powell, 1976: 84; Powell, 1979: 64, pl. 17, fig. 17.
NOT *Spectamen verum*.—Powell, 1979: 64 (remarks on *Spectamen* only); Hayward and Grace, 1981: text fig. 3; Hickman, 1992: 254 = *Solariella plicatula*.

Type material: Holotype (3.55 × 5.30 mm, 3.30 TW, umbilicus 2.00 mm wide) BMNH 1962962, from type locality, 1932, R.R.S. *Discovery II*.

Type Spirits Bay, 34°21.0′S, 172°48.0′E, 59 m.

Other mined (152 specimens NMNZ): 37 Island, Three Kings Islands, 33°58.0 50 m, 25 June 1978, R/V *Tangaroa* ddlesex Bank, NW of Three Kings Islan 171°45.3′E, collected alive, 186–196 m, 1981, R/V *Tangaroa* (20, M.130064); Middlesex Bank, 34°02.1′S, 171°45.8′E, collected alive, 221–206 m, 31 January 1981, R/V *Tangaroa* (5, M.130063); 22 km ENE of Great Island, Three Kings Islands, 34°05.0′S, 172°24.6′E, 200 m, 24 June 1978, R/V *Tangaroa* (92, M.130061); 33 km E of Great Island, 34°14.2′S, 172°32.4′E, 100 m, 24 June 1978, R/V *Tangaroa* (7, M.130065).

Distribution (Figure 14): Middlesex Bank, Three Kings Islands, and off Spirits Bay, 59–550 m; collected alive at 186–221 m from comminuted bryozoan/shell substratum with sponges, corals, hydroids, etc.

Remarks: *Solariella vera* resembles *S. plicatula* in color pattern and shell shape, but differs in having much finer, more numerous spiral threads on the teleoconch. With the exception of a few specimens from the extreme south of its range (see below), *S. vera* lacks the low, rounded axial pleats on the spire and base characteristic of *S. plicatula*. The protoconch in *S. vera* is typically white, rarely pale yellow. The first one or two teleoconch

whorls may be yellow or white; subsequent whorls are typically white with narrow, widely spaced, pale red axial bands that are confined to the spire and do not extend beyond the periphery; the bands are typically absent from a broad subsutural zone but do extend to the suture in a few specimens (e. g., M.130065). A few specimens lack color bands. No specimens have been found brooding young within the umbilicus, though from the size of the umbilicus, it may also be an umbilical brooder. The shell appears to be sexually dimorphic, putative females having an angulate instead of rounded umbilical rim bordered by a considerably stronger spiral thread than in putative males (figures 5–7). Unlike *S. plicatula* and *S. luteola*, which have sex ratios of about 1:1, the ratio of putative females to males in *S. vera* would seem to be more than 18.4:1. Whether the five putative males are simply phenotypic variants of females that otherwise happen to resemble males in shell morphology is unclear. Powell's (1979), Hayward and Grace's (1981), and Hickman's (1992) records of brooding in *S. vera* are based on misidentified specimens of *S. plicatula*.

The radula (figure 126) is typical of the genus, with rather narrow lateromarginal plates. The jaw plates are thin, with rather well-developed elements covering most of the central area from the leading edge almost to the back edge.

Solariella luteola (Powell, 1937)
(Figures 8–12, 13, 19, 43, 127)

Zeminolia luteola Powell, 1937: 179, pl. 51, fig. 1, 2.
Spectamen luteolum.—Powell, 1976: 84; Powell, 1979: 64, pl. 17, fig. 15, 16.

Type material: Holotype BMNH 1962960 and paratype (1962961), from type locality, 17 August 1932, R.R.S. *Discovery II*.

Type locality: Off Three Kings Islands, 34°13.3′S, 172°12.0′E, 260 m.

Other material examined (477 specimens NMNZ): Middlesex Bank, NW of Three Kings Islands, 33°57.0′S, 171°45.4′E, collected alive, 98–103 m, 31 January 1981, R/V *Tangaroa* (20, M.130051); King Bank, N of Three Kings Islands, 33°57.0′S, 172°19.0′E, 128 m, 1 February 1981, R/V *Tangaroa* (9, M.130048); King Bank, 33°57.4′S, 172°19.4′E, collected alive, 128–123 m, 1 February 1981, R/V *Tangaroa* (11, M.72040); 37 km NE of Great Island, Three Kings Islands, 33°58.0′S, 172°30.6′E, 550 m, 25 June 1978, R/V *Tangaroa* (4, M.130053); 18 km N of Great Island, 33°59.2′S, 172°13.6′E, 155 m, 23 June 1978, R/V *Tangaroa* (23, M.93551); Middlesex Bank, 33°59.9′S, 171°45.3′E, 186–196 m, 31 January 1981, R/V *Tangaroa* (11, M.130056); Three Kings Trough, NW of Three Kings Islands, 34°00′S, 171°55′E, 805 m, 15 July 1962, R.N.Z.F.A. *Tui* (20, M.130054); Middlesex Bank, 34°00.9′S, 171°44.7′E, collected alive, 201–216 m, 31 January 1981, R/V *Tangaroa* (52, M.130047); N of Three Kings Islands, 34°01′S, 172°07′E, 622 m, 18 February 1974, R/V *Acheron* (2, M.34620); Middlesex Bank, 34°01.2′S, 171°44.4′E, collected alive, 206–211 m, 31 January 1981, R/V *Tangaroa* (12, M.130044); Middlesex Bank, 34°01.4′S, 171°45.2′E, collected alive, 201–216 m, 31 January 1981, R/V *Tangaroa* (5, M.130052); 13 km N of Great Island, 34°01.8′S, 172°12.0′E, 508 m, 23 June 1978, R/V *Tangaroa* (7, M.130046); Middlesex Bank, 34°02.0′S, 171°44.0′E, 246–291 m, 31 January 1981, R/V *Tangaroa* (44, M.130050); 37 km NW of Great Island, 34°02.0′S, 171°48.4′E, 188 m, 27 June 1978, R/V *Tangaroa* (7, M.130049); Middlesex Bank, 34°02.1′S, 171°45.8′E, collected alive, 221–206 m, 31 January 1981, R/V *Tangaroa* (50, M.130055); 22 km ENE of Great Island, 34°05.0′S, 172°24.6′E, 200 m, 24 June 1978, R/V *Tangaroa* (43, M.130059); off Northeast Island, Three Kings Islands, 34°08.5′S, 172°11′E, collected alive, 102 m, 18 February 1974, R/V *Acheron* (7, M.34254); off Three Kings Islands, 34°10′S, 172°12′E, 252 m, 19 February 1974, R/V *Acheron* (9, M.34019); off Three Kings Islands, 34°11′S, 172°10′E, 91 m, 19 February 1974, R/V *Acheron* (3, M.33753); SE of Great Island, 34°14.1′S, 172°09.0′E, collected alive, 192–202 m, 1 February 1981, R/V *Tangaroa* (10, M.130057); NW of Cape Reinga, 34°14.2′S, 172°32.4′E, 100 m, 24 June 1978, R/V *Tangaroa* (35, M.130058); SE of Great Island, 34°14.8′S, 172°13.6′E, 173–178 m, 2 February 1981, R/V *Tangaroa* (9, M.130091); 39 km SW of Great Island, 34°17.6′S, 171°45.3′E, 427 m, 21 June 1978, R/V *Tangaroa* (22, M.130043); 20 km NW of Cape Maria van Diemen, 34°20.0′S, 172°30.0′E, collected alive, 100 m, 20 June 1978, R/V *Tangaroa* (15, M.93744); SE of Three Kings Islands, 34°20.2′S, 172°21.8′E, collected alive, 121 m, 2 February 1981, R/V *Tangaroa* (21, M.130090); 37 km SW of Great Island, 34°20.4′S, 171°48.2′E, 440 m, 21 June 1978, R/V *Tangaroa* (18, M.130045); N of Cape Reinga, 34°21′S, 172°37′E, 88m, 19 February 1974, R/V *Acheron* (4, M.35915); 28 km S of Great Island, 34°24.0′S, 172°16.8′E, collected alive, 120 m, 20 June 1978, R/V *Tangaroa* (4, M.130092).

Distribution (Figure 13): Middlesex Bank, King Bank, Three Kings Islands, and off Cape Reinga, 88–805 m; collected alive at 98–202 m from comminuted bryozoan and shell substrata with sponges, hydroids, corals, etc.

Remarks: *Solariella luteola* is rather variable in sculpture, protoconch size, color and color pattern. The spire may be sculptured throughout with weak, crowded spiral threads, or all spirals other than a subsutural spiral may become obsolete on the second teleoconch whorl. The protoconch may be white or chrome yellow and ranges in width from 500 to 620 μm (mean = 560 μm). The first teleoconch whorl may be chrome yellow or pinkish white, and subsequent whorls are either uniform white or pinkish white or pinkish buff with the addition of narrow, pale red sigmoidal axial bands that entirely traverse the whorls to the umbilical rim, extending onto the umbilical wall in some specimens. Specimens from shallower than 200 meters are typically the most strongly

sculptured and pigmented, whereas specimens from depths greater than 400 meters are typically uniform white and weakly sculptured.

The radula (figure 127) is closest to that of *S. plicatula,* differing in having more broadly angulate cutting areas on the lateral teeth. The jaw plates are extremely thin, with weak elements covering the anterior third.

S. lutcola broods its young within the umbilicus and has sexually dimorphic shells, shells of females having a more voluminous umbilicus with a flatter, steeper wall than males, and a more prominent spiral cord at the umbilical rim (figures 8–12). The umbilical rim is strongly angulated in both sexes, unlike *S. plicatula* in which this is a characteristic of females alone. One specimen examined had a shelled embryo deep within the umbilicus, and another had two (M.130055), though to judge from the volume of the umbilicus, the number of young brooded at any one time is probably considerably greater than this.

Compared with *S. vera,* which it most closely resembles, *S. lutcola* differs in that spiral sculpture on the spire is more or less obsolete or consists of finer, closer, more numerous spiral threads, in that the protoconch is generally larger (mean = width 560 μm, cf. 510 μm), and in that the color bands (when present) are more strongly sigmoidal and traverse the spire and the base instead of only the spire. *Solariella lutcola* and *S. vera* have been taken together at several stations throughout their ranges, living sympatrically at 221–206 meters depth on Middlesex Bank (M.130055, M.130063). Specimens from the south side of the Johnson Trough (figure 13; M.130092, M.130058, M.93744, M.130090, M.35915), between the Three Kings Islands and Cape Reinga, attain smaller size than northern shells, and a few of them have rounded axial folds, characteristics that are enhanced to the southeast. Southern specimens with axial folds resemble *S. plicatula,* though they are otherwise indistinguishable from northern populations of *S. lutcola* and they are not strictly morphologically intermediate.

Solariella exigua new species
(Figures 14–17, 21, 44)

Description: Shell up to 4.60 mm wide, wider than high, of moderate thickness, widely umbilicate. Protoconch white; first 1.2–1.3 teleoconch whorls yellow; subsequent whorls white with dull red, irregular, typically subquadrate, axial maculations on abapical two thirds of [illegible] whorls. Protoconch 430–480 μm wide, sculptured [illegible] nules and a fine spiral thread, tip of apical [illegible] rounded. Teleoconch up to 3.0 convex [illegible] horl rather evenly convex, subsequent [illegible] ntal or outwardly adapically sloping [illegible] dult whorl slightly flattened above and [illegible] periphery. Primary sculpture of pr[illegible] ds that multiply by intercalation, 8–13 on [illegible] 25 on base in adults, innermost basal spiral [illegible] l rim: spire spirals stronger and angulate in section, with interspaces wider than each spiral; basal spiral finer and rounded in section, with interspaces narrower than each spiral except beside umbilical rim. Secondary sculpture of weak axial pleats confined to adapical third on spire on last adult whorl, fine collabral growth lines throughout. Umbilicus perspective to protoconch, diameter 41–46% of adult shell diameter, rim angulate; wall sculptured with spiral threads and fine collabral growth lines, last whorl more or less flat over outer two thirds. Aperture subcircular, lips thin and simple, thickest at angulation of umbilical rim.

Type material: Holotype NMNZ M.131480 and 6 paratypes NMNZ M.43711, from type locality, 18 February 1974, R/V *Acheron.* Paratypes (16 NMNZ): middle Southeast Bay, Great Island, 34°10′S, 172°08′E, collected alive, 42–46 m, 18 February 1974, R/V *Acheron* (14 NMNZ M.33833, 1 AMS), Southeast Bay, Great Island, 30 m, 5 February 1993, F. Brook (2, M.117426).

Type locality: Middle Southeast Bay, Great Island, Three Kings Islands, 34°10′S, 172°08′E, 42–46 m.

Other material examined: Off Rangaunu Bay, 34°49.6′S, 173°15.0′E, 23 m, 27 January 1981, R/V *Tangaroa* (7, M.130071).

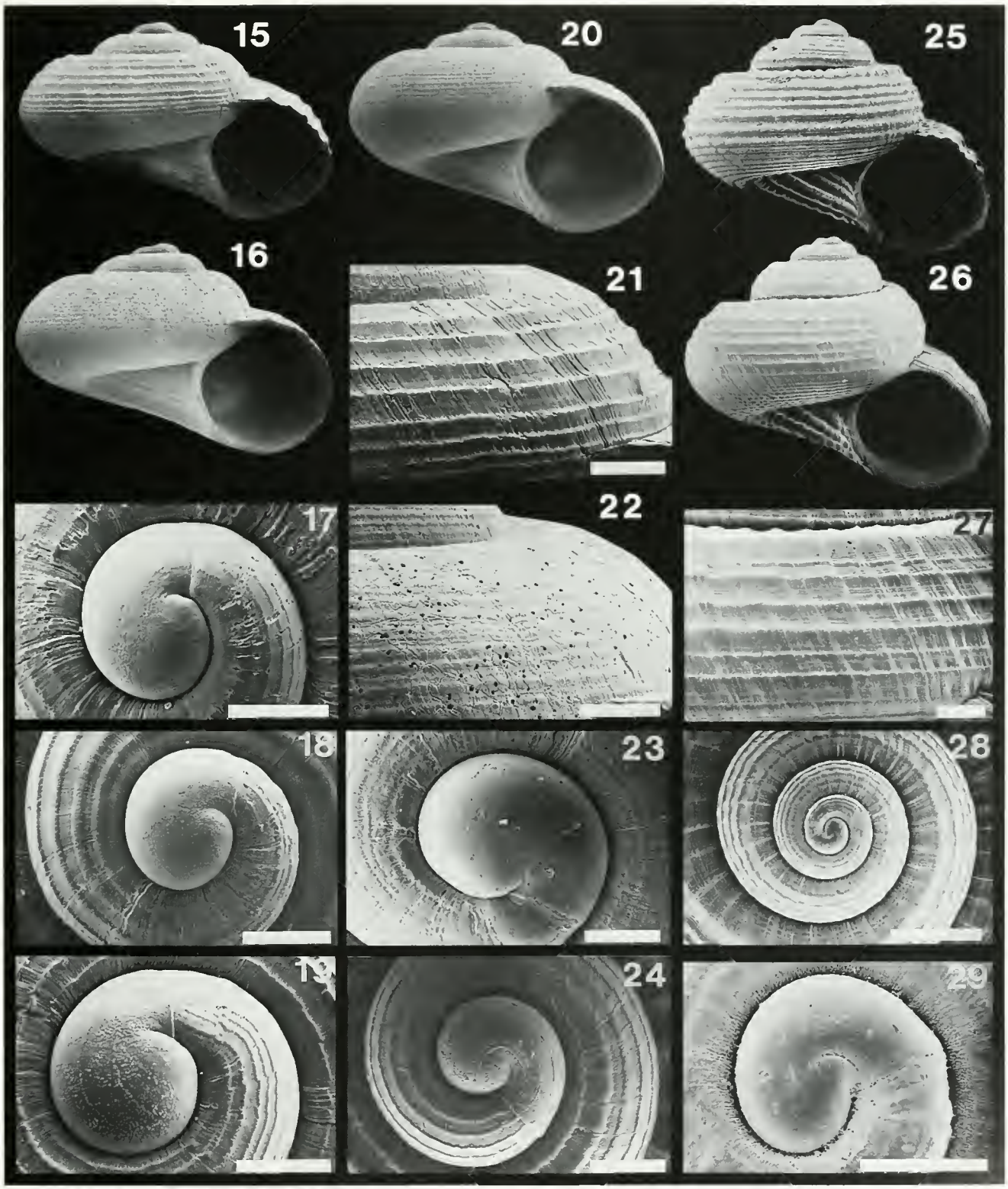
Distribution (Figure 14): Off Three Kings Islands, and off Rangaunu Bay, 23–55 m, living at 42–46 m on gravel; dead shells on comminuted bryozoan/shell or shell substrata.

Remarks: *Solariella exigua* most closely resembles *S. plicatula* and *S. vera,* differing from both in having finer, closer, more numerous spiral threads on the spire, a smaller protoconch (width 430–480 μm: mean = 462 μm, cf. 470–530 μm: mean = 498 μm and 500–530 μm: mean = 510 μm), and in attaining smaller size (maximum width 4.60 mm, cf. 7.00 mm and 5.20 mm). It differs further from both in showing no obvious sexual dimorphism in the shell.

Etymology: Little (Latin).

Solariella basilica new species
(Figures 14, 20, 22, 23)

Description: Shell up to 8.90 mm wide, wider than high, of moderate thickness, widely umbilicate. Protoconch white; first 1.0–1.3 teleoconch whorls yellow, fading over next half whorl to white, subsequent whorls uniform white. Protoconch 600 μm wide, smooth, tip of apical fold bluntly rounded. Teleoconch up to 3.75 convex whorls; first whorl rather evenly convex, subsequent whorls with horizontal sutural ramp with rounded rim, last adult whorl slightly flattened above and below rounded periphery. Primary sculpture of fine, crowded spiral threads that multiply by intercalation, angulate in section on spire, rounded in section on base, 17 on penultimate whorl and about 30 on base (subadult holotype), 20 on penultimate whorl and 22 on base (adult paratype), innermost basal spiral at umbilical rim. Fine



Figures 15–29. Shells of species of *Solariella*. **15–17, 21.** *S. exigua* new species. **15, 17, 21.** Holotype, Southeast Bay, Great Island, Three Kings Islands, 42–46 m, M.131480 (2.40 × 4.00 mm). **16.** Paratype, Southeast Bay, 55 m, M.33833 (2.90 × 4.55 mm). **18.** *S. plicatula* (Murdoch and Suter), off Poor Knights Islands, 146 m, M.35115. **19.** *S. luteola* (Powell), off Northeast Island, Three Kings Islands, 102 m, M.34254. **20, 22, 23.** *S. basilica* new species, holotype, Southeast Bay, 55 m, M.131557. **24, 25.** *S. semireticulata* (Suter). **24.** E of Forty Fours, Chatham Islands, 238 m, M.10837. **25.** SE of Nugget Point, Otago, 140 m, M.59359 (3.55 × 4.80 mm). **26–29.** *S. tryphenensis* (Powell), off Te Arai Point, 35 m, M.130840 (4.30 × 5.40 mm). Scale 28 = 1 mm; others = 250 μm.

collabral growth lines throughout. Umbilicus perspective to protoconch, diameter 33% (adult)–38% (subadults) of shell diameter, rim angulate, projecting inwards at maturity to overhang outer umbilical wall; wall of each whorl steep, sculptured with low spiral threads and fine collabral growth lines. Aperture subcircular, lips thin and simple, thickest at angulation of umbilical rim.

Type material: Holotype (2.50 × 3.80 mm, subadult) NMNZ M.131557 and 2 subadult paratypes (M.33828), from type locality, 18 February 1974, R/V *Acheron*. Paratypes: Middlesex Bank, NW of Three Kings Islands, 33°59.9′S, 171°45.3′E, 186–196 m, 31 January 1981, R/V *Tangaroa* (1 adult, M.131481); NW of Cape Reinga, 34°14.2′S, 172°32.4′E, 100 m, 24 June 1978, R/V *Tangaroa* (1 subadult, M.131539).

Type locality: Outer Southeast Bay, Great Island, Three Kings Islands, 34°10′S, 172°08′E, 55 m.

Distribution (Figure 14): Off Great Island, Three Kings Islands, and Middlesex Bank, 55–196 m (dead), on gravel and comminuted bryozoan/shell substrata.

Remarks: *Solariella basilica* resembles *S. exigua* in having crowded spiral threads on the spire and base but differs in having finer, more numerous threads at equivalent stages of shell growth, in attaining much larger size (maximum width 8.90, cf. 4.60 mm), in having a wider protoconch (600 μm, cf. 430–480 μm) and a narrower umbilicus (33–38% instead of 41–46% of shell width), and in the last few teleoconch whorls being uniform white instead of axially banded. *Solariella basilica* differs from *S. vera* in having finer, more numerous spiral threads on the spire and base (basal spirals obsolete in *S. vera*). Empty shells of *S. basilica* occurred together with *S. exigua* at the type locality and with *S. vera* at Middlesex Bank (M.131481, M.130064).

Etymology: Royal (Greek).

Solariella semireticulata (Suter, 1908)
(Figures 24, 25, 48)

Monilea (Minolia) semireticulata Suter, 1908: 22, pl. 2, fig. 1; Suter, 1913: 142, pl. 33, fig. 13.
Spectamen semireticulata.—Powell, 1926: 44, 45.
Zeminolia semireticulata.—Finlay, 1926: 360; Powell, 1955: 55.
Spectamen semireticulatum.—Powell, 1976: 84; Powell, 1979: 64, pl. 17, fig. 18.

Type material: Lectotype (Boreham, 1959) NZGS TM467.

Type locality: Off the Snares Islands, 91 m.

Other material examined (88 specimens NMNZ): Pegasus Canyon, NE of Banks Peninsula, 43°31.0′S, 173°30.8′E, dead alive, 256–293 m, 21 February 1979, R/V [illegible] M.94717); Papanui Canyon, off Otago Peninsula, 45°51′S, 171°00′E, 348–220 m, 15 February [illegible] *Acheron* (2, M.94629); Saunders Canyon, off East Otago, 45°56′S, 170°54′E, 360 m, 30 June 1975, R/V *Munida* (5, M.48847); off Taiere, Dunedin, 46°12.0′S, 170°41.5′E, 150 m, 1 September 1976, R/V *Munida* (2, M.65802); Saunders Canyon, off East Otago, 45°56′S, 170°54′E, 420 m, 27 October 1967, R/V *Munida* (1, M.28426); SE of Nugget Point, East Otago, 46°40′S, 170°00′E, 140 m, 27 March 1978, F.R.V. *James Cook*, coll. L. Paul (20, M.59359); 0.8 km SW of Hare's Ears, Doubtful Sound entrance, 45°17.2′S, 166°49.3′E, collected alive, 146 m, 7 January 1977, R/V *Acheron* (24, 58783); E of Forty Fours, Chatham Islands, 44°04′S, 175°23.5′W, collected alive, 238 m, 1 February 1954, M.V. *Alert* (13, M.10837).

Distribution (Figure 48): East coast of South Island, Doubtful Sound, Chatham Rise, also Snares and Auckland islands (Powell, 1955), 91–421 m; collected alive at 146–238 m from sand and shell substrata.

Remarks: *Solariella semireticulata* differs from the superficially similar species *S. plicatula* in having stronger teleoconch sculpture, in being uniform white, and in that the umbilical rim is consistently rounded. Unlike *S. plicatula*, *S. semireticulata* exhibits no obvious shell dimorphism and is probably not an umbilical brooder.

Solariella tryphenensis (Powell, 1930)
(Figures 26–29, 45, 49)

Zeminolia tryphenensis Powell, 1930: 534, pl. 62, fig. 16–18.
Spectamen tryphenense.—Powell, 1976: 84; Powell, 1979: 65, pl. 17, fig. 12–14.

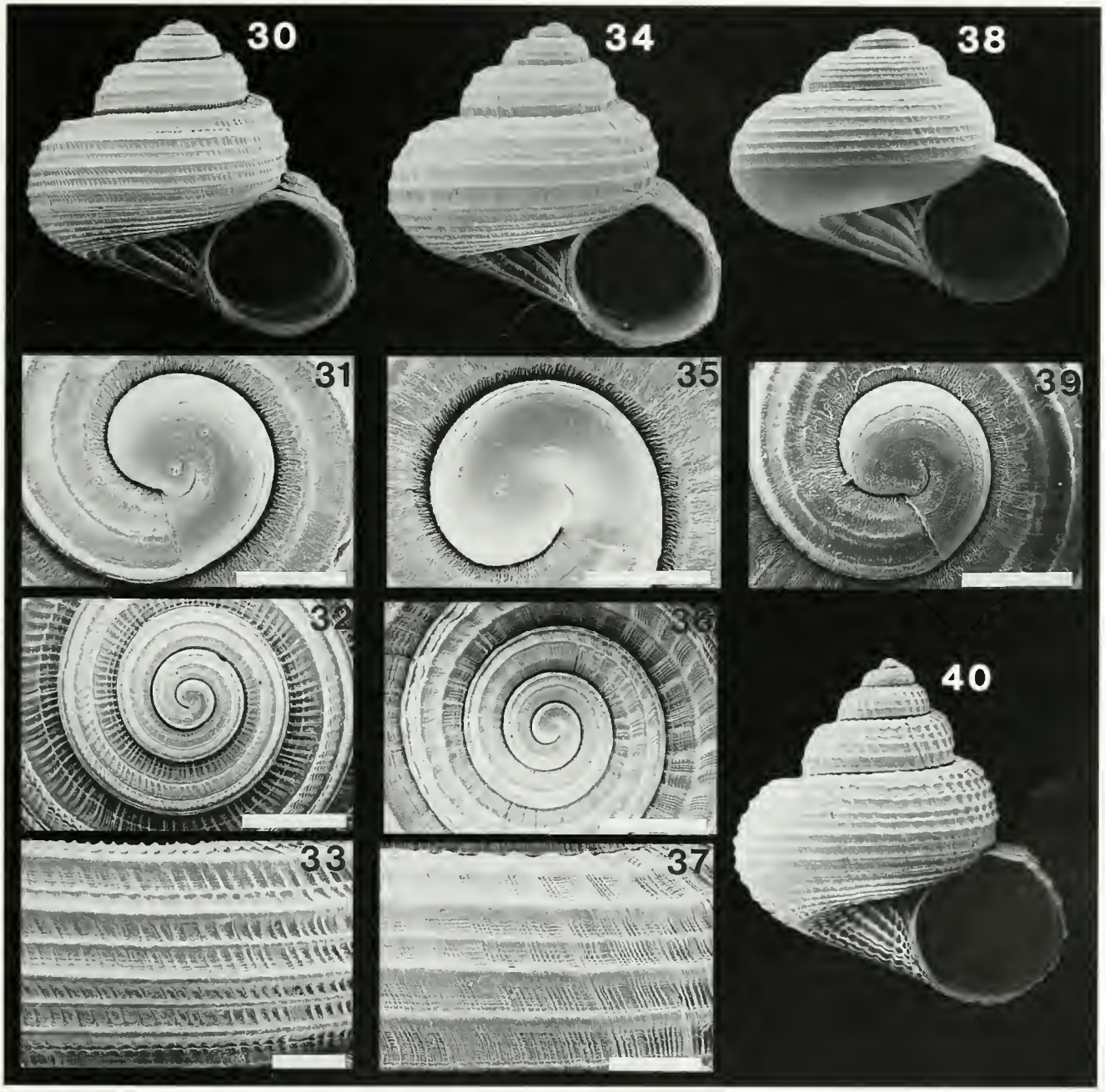
Type material: Holotype AIM AK72175, from type locality.

Type locality: Tryphena Bay, Great Barrier Island, 11 m.

Other material examined (many specimens NMNZ): Great Exhibition Bay, 34°33.4′S, 173°04.8′E, 63 m, 27 January 1981, R/V *Tangaroa* (51, M.113337); off Twin Rocks, Bay of Islands, 35°10′S, 174°18′E, 46–73 m, 10 December 1973, M.V. *Kokinga* (2, M.42245); off Motuwheteke Island, Bay of Islands, 35°12′S, 174°17′E, 22–31 m, 14 December 1973, M.V. *Kokinga* (1, M.41864); SE of Te Arai Point, Mangawhai, Northland, 36°10.5′S, 174°42.0′E, collected alive, 35 m (dredged for beach replenishment at Mission Bay, Auckland) 3 March 1996, B.A. Marshall and N.J. Peterson (10, M.130840), B.F. Hazelwood, 1996 (51, M.131392), P. Poortman (many, M.131712); off Mayor Island, 37°16.7′S, 176°17.5′E, 104–109 m, 22 January 1979, R/V *Tangaroa* (10, M.67431) off E side of Mayor Island, 37°18.9′S, 176°16.2′E, 59–74 m, 22 January 1979, R/V *Tangaroa* (102, M.65681).

Distribution (Figure 49): Northeastern North Island, from Great Exhibition Bay to Mayor Island, 11–109 m, collected alive at 35 m on clean sand and shell substratum.

Remarks: Among New Zealand *Solariella* species, *S. tryphenensis* is characterized by its large size and strong



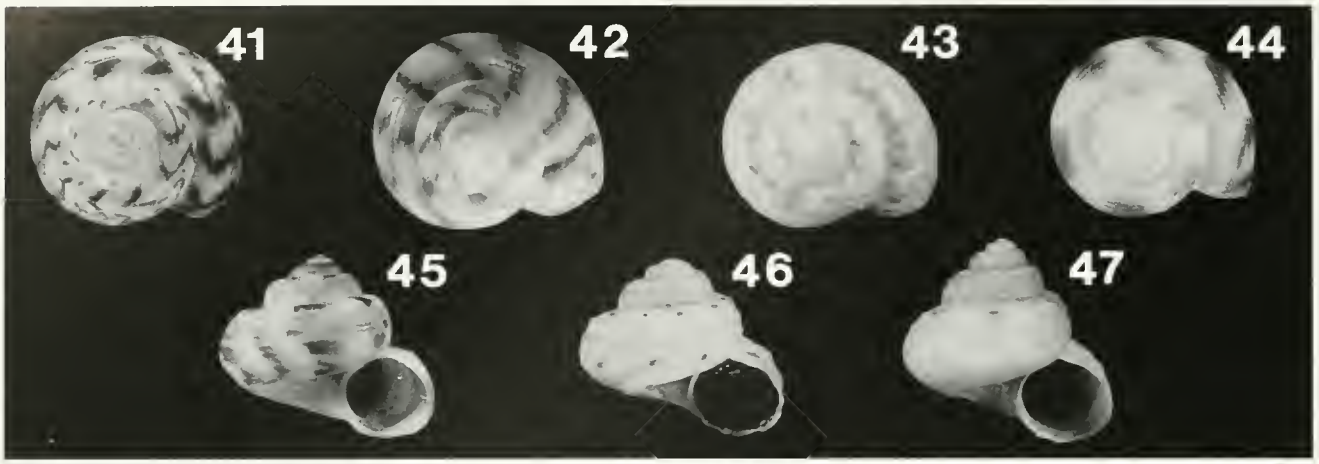
Figures 30–40. Shells of species of *Solariella*. **30–33.** *S. benthicola* (Powell), Middlesex Bank, 221–206 m, M.130079 (5.30 × 5.80 mm). **34–37.** *S. peristicta* new species, holotype, NW of Cape Reinga, 78 m, M.131563 (4.55 × 5.05 mm). **38, 39.** *S. flavida* new species, holotype, NW of Cape Reinga, 100 m, M.131564 (3.30 × 4.40 mm). **40.** *S. amabilis* (Jeffreys), Snorre oil field, N North Sea, 292–340 m, Swedish Museum of Natural History (4.20 × 4.30 mm). Scales 32, 36 = 1 mm, others = 250 μm.

sculpture, and in being pale buff with a deep red (seldom brown) color pattern of subsutural maculations and irregular, wavy axial bands that extend from the maculations to about midway across the base. *S. tryphenensis* ranges into shallower water than other New Zealand species, perhaps as shallow as 11 meters, and it has an extremely patchy distribution.

Solariella benthicola (Powell, 1937)
(Figures 30–33, 46, 48, 128)

Zeminolia benthicola Powell, 1937: 180, pl. 51, fig. 4; *Spectamen benthicola*.—Powell, 1976: 84; Powell, 1979: 64

Type material: Holotype BMNH 1962963, from type locality, 17 August 1932, R.R.S. *Discovery II*.



Figures 41–47. Shells of species of *Solariella*. **41.** *S. plicatula* (Murdoch and Suter), off Rangaunu Bay, 63 m, M.130750 (4.00 × 5.65 mm). **42.** *S. vera* (Powell), ENE of Great Island, Three Kings Islands, 200 m, M.130061 (5.05 × 7.50 mm). **43.** *S. luteola* (Powell), Middlesex Bank, 98–103 m, M.130051 (4.40 × 6.40 mm). **44.** *S. exigua* new species, paratype, Southeast Bay, Three Kings Islands, 55 m, M.33833 (2.85 × 4.50 mm). **45.** *S. tryphenensis* (Powell), off Te Arai Point, 35 m, M.130840 (4.80 × 5.70 mm). **46.** *S. benthicola* (Powell), Middlesex Bank, 221–206 m, M.130079 (5.35 × 5.60 mm). **47.** *S. peristicta* new species, NW of Cape Reinga, 78 m, M.131492 (4.15 × 4.60 mm).

Type locality: Off Three Kings Islands, 34°13.3′S, 172°12.0′E, 260 m.

Other material examined (114 specimens NMNZ): 18 km N of Great Island, Three Kings Islands, 33°59.2′S, 172°13.6′E, 155 m, 23 June 1978, R/V *Tangaroa* (4, M.130073); Middlesex Bank, NW of Three Kings Islands, 33°59.9′S, 171°45.3′E, 186–196 m, 31 January 1981, R/V *Tangaroa* (15, M.130076); Three Kings Trough, NW of Three Kings Islands, 34°00′S, 171°55′E, 805 m, 15 July 1962, R.N.Z.F.A. *Tui* (30, M.48959); Middlesex Bank, 34°00.9′S, 171°44.7′E, collected alive, 201–216 m, 31 January 1981, R/V *Tangaroa* (2, M.130077); N of Three Kings Islands, 34°01′S, 172°07′E, 622 m, 18 February 1974, R/V *Acheron* (2, M.130083); 13 km N of Great Island, 34°01.8′S, 172°12.0′E, 508 m, 23 June 1978, R/V *Tangaroa* (6, M.131501); Middlesex Bank, 34°02.0′S, 171°44.0′E, 246–291 m, 31 January 1981, R/V *Tangaroa* (10, M.130081); 37 km NW of Great Island, 34°02.0′S, 171°48.4′E, 188 m, 27 June 1978, R/V *Tangaroa* (2, M.130075); Middlesex Bank, 34°02.1′S, 171°45.8′E, collected alive, 221–206 m, 31 January 1981, R/V *Tangaroa* (5, M.130079); SE of Great Island, 34°14.1′S, 172°09.0′E, collected alive, 192–202 m, 1 February 1981, R/V *Tangaroa* (4, M.130078); NW of Cape Reinga, 34°14.2′S, 172°32.4′E, 100 m, 24 June 1978, R/V *Tangaroa* (1, M.130074); 39 km SW of Great Island, 34°[illegible]′S, 171°45.3′E, 427 m, 21 June 1978, R/V *Tangaroa* (1, M.130082); N of North Cape, 34°20.0′S, [illegible]′E, collected alive, 163–168 m, 27 January 1981, R/V *Tangaroa* (1, M.131502); SE of Three Kings Islands, 34°20.[illegible]′S, [illegible]′E, collected alive, 121 m, 2 February 1981, R/V *Tangaroa* (13, M.130080); 28 km S of Great Island, 34°24.0′S, 172°16.8′E, 120 m, 20 June 1978, R/V *Tangaroa* (1, M.130072); E of North Cape, 34°25.0′S, 173°13.1′E, 327–257 m, 27 January 1981, R/V *Tangaroa* (22, M.48959).

Distribution (figure 48): Off Three Kings Islands and off North Cape, 100–805 m, collected alive at 121–216 m on comminuted bryozoan/shell substratum with sponges, corals, hydroids, etc.

Remarks: Among species from the New Zealand region, *Solariella benthicola* most closely resembles *S. tryphenensis*, differing principally in being smaller relative to the number of whorls (maximum width 5.90 mm, 4.3 TW cf. 6.70 mm, 4.1 TW); in having crisp axial riblets rather than low, rounded axial folds on the spire; and in being more sparsely pigmented. Specimens from the extreme south of its range and many from extreme depths have stronger, more widely spaced axial riblets than other material but seem likely to be conspecific.

The radula (figure 128) is typical of the genus, with rather narrow lateromarginal plates. The elements on the extremely thin jaw plates are weak and confined to the anterior half, weakening posteriorly.

Solariella peristicta new species
(Figures 34–37, 47, 49, 129)

Description: Shell up to 5.80 mm wide, slightly wider than high, of moderate thickness, umbilicate, almost lustreless. Periostracum apparently calcified (intritacalx). Protoconch white. Teleoconch pale buff or white, spiral cords with small, irregular yellowish brown or pale red spots; paler, irregular, wavy axial bands on base and outer part of umbilicus; some specimens pinkish white with irregular, wavy, red axial bands that extend from suture into umbilicus; greenish nacre showing through translucent outer shell layers. Protoconch 130 μm wide,

Figure 48. Map of New Zealand region showing distributions of species of *Solariella*: *S. plicatula* (Murdoch and Suter) (●), *S. semireticulata* (Suter) (▲), and *S. benthicola* (Powell) and *S. flavida* new species (★).

sculptured with 4 fine, crisp spiral threads and sparse granules, tip of apical fold pinched. Teleoconch up to 4.25 whorls. First whorl evenly convex, subsequent whorls with horizontal sutural ramp with angulate rim, rather evenly convex from ramp rim to suture within umbilicus. Primary sculpture of prominent, narrow spiral cords that multiply by intercalation and enlarge to resemble adjacent spirals, interspaces several times wider than each spiral; 4 on first 1.5 spire whorls, adapical 3 similar, abapical spiral more or less covered by succeeding whorls; adults with 6 on penultimate whorl and 11–14 on base and umbilical wall. Second and subsequent whorls traversed by low, rounded axial pleats, strongest on adapical half of each spire whorl, evanescent abapically. Fine, crisp, crowded collabral growth lines throughout; fine, crisp, interstitial spiral threads commencing after second whorl, becoming crowded throughout. Umbilicus perspective to protoconch, rim evenly rounded, wall of each whorl convex, sculptured with spiral cords and fine collabral and spiral threads. Aperture subcircular, lips thin and simple.

Radula (figure 129) typical of the genus, lateromarginal plates rather narrow. Jaw plates very thin, weak elements confined to the anterior half.

Type material: Holotype NMNZ M.131563 and 3 paratypes M.131492, from type locality, 2 February 1981, R/V *Tangaroa,* collected alive. Paratypes (14): Middlesex Bank, NW of Three Kings Islands, 33°57.0′S, 171°45.4′E, collected alive, 98–103 m, 31 January 1981, R/V *Tangaroa* (5, M.131493); King Bank, N of Three Kings Islands, 33°57.4′S, 172°19.4′E, collected alive, 128–123 m, 1 February 1981, R/V *Tangaroa* (8 NMNZ M.131494, 1 AMS).

Type locality: NW of Cape Reinga, 34°25.0′S, 172°27.8′E, 78 m.

Other material examined (100 specimens NMNZ): King Bank, N of Three Kings Islands, 33°57.4′S, 172°19.4′E, 128–123 m, 1 February 1981, R/V *Tangaroa* (13, M.130084); Three Kings Trough, NW of Three Kings Islands, 34°00′S, 171°55′E, 805 m, 15 July 1962, R.N.Z.F.A. *Tui* (5, M.130085); N of Three Kings Islands, 34°01′S, 172°07′E, 622 m, 18 February 1974, R/V *Acheron* (6, M.34619); Middlesex Bank, NW of Three Kings Islands, 34°01.2′S, 171°44.4′E, 206–211 m, 31 January 1981, R/V *Tangaroa* (3, M.131496); Middlesex Bank, 34°02.0′S, 171°44.0′E, 246–291 m, 31 January 1981, R/V *Tangaroa* (5, M.131495); 11 km NW of Great Island, Three Kings Islands, 34°06.5′S, 172°04.7′E, 310 m, 30 June 1978, R/V *Tangaroa* (2, M.61461); off Northeast Island, Three Kings Islands, 34°08.5′S, 172°11′E, collected alive, 102 m, 18 February 1974, R/V *Acheron* (13, M.34253); outer Southeast Bay, Great Island, 34°10′S, 172°08′E, 55 m, 18 February 1974, R/V *Acheron* (4, M.33825); off Three Kings Islands, 34°10′S, 172°12′E, 252 m, 19 February 1974, R/V *Acheron* (5, M.34024); Arch Pinnacle, Princes Islands, Three Kings Islands, 40 m, 10 March 1983, F. Brook (1, M.109336); 39 km SW of Great Island, 34°17.6′S, 171°45.3′E, 427 m, 21 June 1978, R/V *Tangaroa* (5, M.131500); N of Cape Reinga, 34°21′S, 172°37′E, 88 m, 19 February 1974, R/V *Acheron* (4, M.35912); off Rangaunu Bay, 34°42.8′S, 173°14.5′E, 63 m, 27 January 1981, R/V *Tangaroa* (32, M.130751); NW of Whangaroa Harbour, 34°54.0′S, 173°42.6′E, 83 m, 26 January 1981, R/V *Tangaroa* (1, M.130768); ENE of Great Barrier Island, vicinity of 35°43′S, 176°18′E, 329 m, 21 July 1962, R.N.Z.F.A. *Tui* (1, M.44047).

Distribution (Figure 49): Off Three Kings Islands, and northeastern North Island as far south as Great Barrier Island, 40–805 m, collected alive at 78–128 m on comminuted bryozoan/shell substrata with sponges, corals, hydroids, etc.

Remarks: Compared with *Solariella tryphenensis,* which it most resembles, *S. peristicta* differs in attaining smaller size (width up to 5.80 mm cf. 6.70 mm) and in having crisper, more crowded collabral axial riblets on the last few whorls that produce a fine reticulation with the secondary spiral threads. *Solariella peristicta* resem

Figure 49. Map of New Zealand region showing distributions of species of *Solariella*: *S. tryphenensis* (Powell) (▲) and *S. peristicta* new species (■).

bles the sympatric species *S. benthicola* in size, shape, and radular morphology but has much coarser axial sculpture.

Etymology: Dappled (Greek).

Solariella flavida new species
(Figures 38, 39, 48)

Description: Shell up to 5.05 mm wide, slightly wider than high, of moderate thickness, umbilicate. Periostracum apparently calcified (intritacalx). Protoconch white. First 2.5 teleoconch whorls yellow, sutural ramp white; subsequent whorls white with pale yellow subsutural [illegible] and pale yellow, irregular axial bands that [illegible] low maculations and extend to either [illegible] across base or deep into umbilicus. Pro[illegible] µm wide, sculptured with 5 fine, crisp [illegible] crowded granules, tip of apical fold [illegible] Teleoconch up to 3.75 whorls with narrow [illegible] horizontal sutural ramp; rather evenly [illegible] up to suture within umbilicus. Primary sculpture of [illegible] narrow spiral cords that multiply by intercalation and enlarge to resemble adjacent spirals, strong on spire, strongest on inner third of base and umbilical wall, interspaces several times wider than each spiral, finer and crowded on outer part of base; 4 on first spire whorl, adapical 3 similar, abapical spiral more or less covered by succeeding whorls; adults with 8 or 9 on penultimate whorl, 20–25 on base and umbilical wall. Second and subsequent whorls traversed by weak, inconspicuous, rounded axial pleats, strongest on spire, evanescent on base. Fine, crisp, crowded collabral growth lines throughout; fine, crisp spiral threads commencing after first whorl, becoming crowded and covering interspaces on spire, base, and umbilical wall. Umbilicus perspective to protoconch, rim evenly rounded, whorl of each whorl convex, sculptured with spiral cords and fine collabral and spiral threads. Aperture subcircular, lips thin and simple. Radula unknown (only available live-taken specimens decayed).

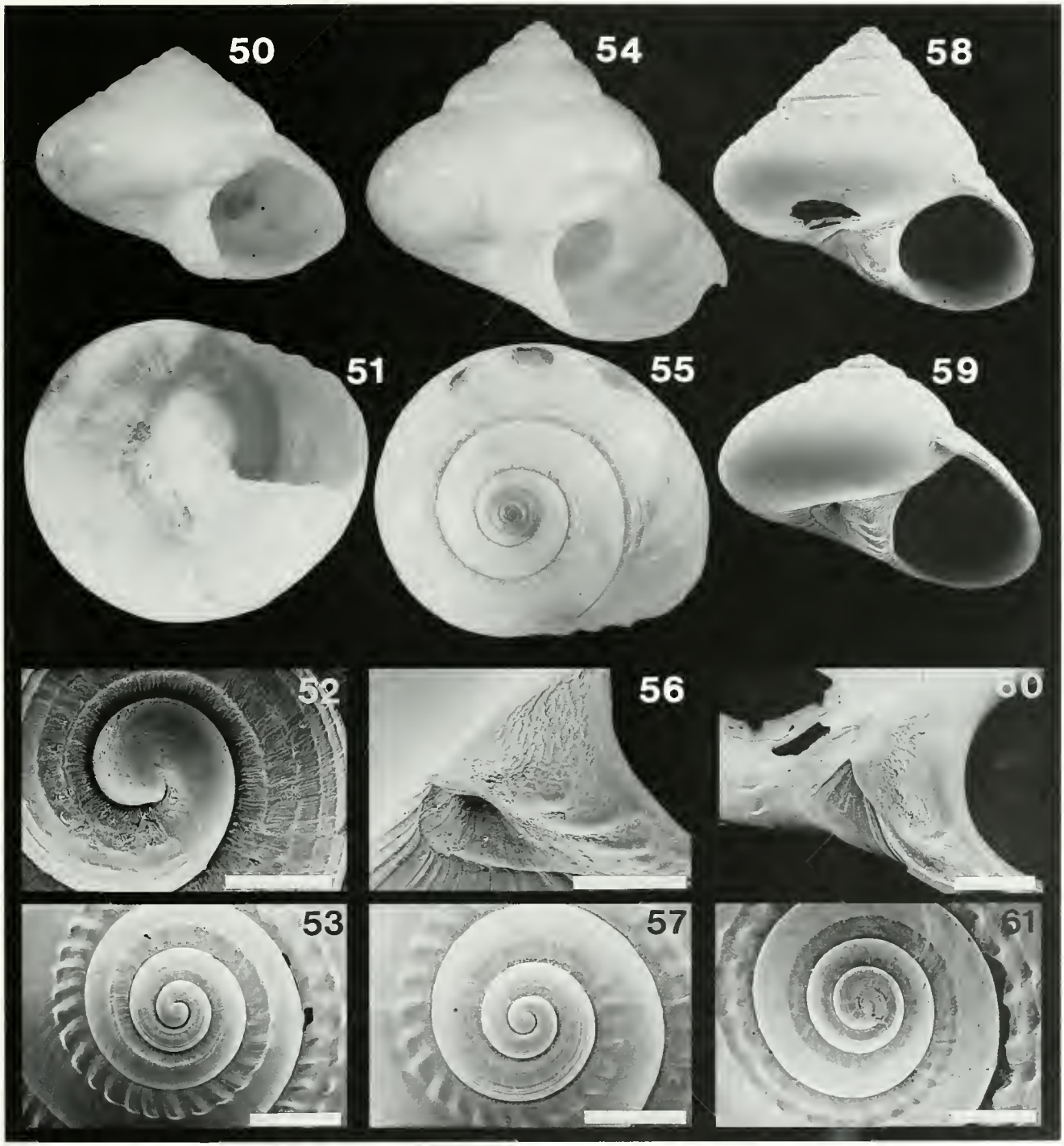
Type material: Holotype NMNZ M.131564 and 29 paratypes (28 NMNZ M.131512, 1 AMS), from type locality, 24 June 1978, R/V *Tangaroa*, collected alive. Paratypes (15 NMNZ): Middlesex Bank, NW of Three Kings Islands, 33°57.0′S, 171°45.4′E, 98–103 m, 31 January 1981, R/V *Tangaroa* (3, M.131508); Middlesex Bank, 33°59.9′S, 171°45.3′E, 186–196 m, 31 January 1981, R/V *Tangaroa* (8, M.131507); Middlesex Bank, 34°01.4′S, 171°45.2′E, 201–216 m, 31 January 1981, R/V *Tangaroa* (1, M.131510); Middlesex Bank, 34°02.1′S, 171°45.8′E, 221–206 m, 31 January 1981, R/V *Tangaroa* (2, M.131511); 37 km NW of Great Island, Three Kings Islands, 34°02.0′S, 171°48.4′E, 188 m, 27 June 1978, R/V *Tangaroa* (1, M.131509).

Type locality: NW of Cape Reinga, 34°14.2′S, 172°32.4′E, 100 m.

Other material examined (34 specimens NMNZ): King Bank, N of Three Kings Islands, 33°57.4′S, 172°19.4′E, 128–123 m, 1 February 1981, R/V *Tangaroa* (5, M.72047); 37 km NE of Great Island, Three Kings Islands, 33°58.0′S, 172°30.6′E, 550 m, 25 June 1978, R/V *Tangaroa* (3, M.93904); Middlesex Bank, NW of Three Kings Islands, 34°01.2′S, 171°44.4′E, 206–211 m, 31 January 1981, R/V *Tangaroa* (2, M.131506); Middlesex Bank, 34°02.0′S, 171°44.0′E, 246–291 m, 31 January 1981, R/V *Tangaroa* (14, M.131505); 22 km ENE of Great Island, 34°05.0′S, 172°24.6′E, 200 m, 24 June 1978, R/V *Tangaroa* (8, M.93456); off Three Kings Islands, 34°10′S, 172°12′E, 252 m, 19 February 1974, R/V *Acheron* (1, M.34020); NW of Cape Reinga, 34°22.8′S, 172°24.6′E, 121 m, 2 February 1981, R/V *Tangaroa* (1, M.131503).

Distribution (Figure 48): Off Three Kings Islands and off Cape Reinga, 98–550 m, collected alive at 100 m on comminuted bryozoan/shell substratum with sponges, corals, hydroids, etc.

Remarks: Compared with *Solariella tryphenensis* and *S. peristicta*, which it resembles in shape, *S. flavida* differs principally in having finer primary spiral cords on



Figures 50–61. Shells of species of *Bathymophila*. **50–53.** *B. gravida* new species **50, 51.** Holotype, N Three Kings Rise, 1137–1150 m, NZOI H680 (9.50 × 12.6 mm). **52, 53.** Paratype, N Three Kings Rise, 1216–1385 m, NZOI P1123 (10.0 × 13.4 mm). **54, 55.** *B.* sp. cf. *gravida* new species, N Three Kings Rise, 1216–1385 m, NZOI U602 (12.0 × 13.0 mm). **56, 57, 59.** *B. callomphala* (Schepman), paralectotype, Sulu Sea, 450 m, ZMA 3.08.050 (4.60 × 6.50 mm). **58, 60, 61.** *B. valentia* new species, holotype, N Three Kings Rise, 1570–1563 m, NZOI 11681 (7.40 × 8.50 mm). Scale 52 = 250 μm, others = 1 mm.

the spire (8 or 9, cf. 5–8 and 6, respectively, on penultimate whorl in adults) and in having a yellow color pattern. *S. flavida* and *S. peristicta* have been taken together as empty shells at five stations, suggesting that they live in close proximity to one another, if not sympatrically.

Etymology: Yellowish (Latin).

Genus *Bathymophila* Dall, 1881

Bathymophila Dall, 1881: 102. Type species (by monotypy): *Margarita* (*Bathymophila*) *euspira* Dall, 1881; Recent, Atlantic.

Ethaliopsis Schepman, 1908: 51. Type species (by monotypy): *Solariella* (*Ethaliopsis*) *callomphala* Schepman, 1908; Recent, Indonesia.

Remarks: The radula of the type species of *Bathymophila* is unknown, and *Bathymophila* has traditionally been referred to Margaritinae because the shell bears a general resemblance to species of *Margarites* Gray, 1847 (Quinn, 1979). The type species of *Bathymophila* and *B. bairdi* (Dall, 1889) (Quinn, 1979, figs. 1–4) are closely similar to *Ethaliopsis callomphala* (Schepman, 1908) (figures 56, 57, 59) in gross shell facies. All three are distinctive in having spiral sculpture on the earliest teleoconch whorls, subsequent teleoconch whorls smooth apart from (usually) a subsutural row of nodules, and the umbilicus filled by a heavy callus with a granular surface and a small nodule near the abapical extremity. *Bathymophila gravida* new species appears to have exceptionally variable shell morphology and to encompass within its variation forms that are scarcely distingnishable from *B. euspira* or *B. bairdi* in gross morphology. The radula of *B. gravida* new species (figures 130, 131) is essentially similar to that of *E. callomphala* (Schepman, 1908, pl. 9, fig. 9) but is distinctive in having a flagellum-like projection on the lateromarginal plate. *Ethaliopsis* is here treated as a synonym of *Bathymophila*, because there seems to be no way of justifying continued separation. The *Bathymophila* radula is strongly similar to those of the type species of *Microgaza* (Marshall, 1979, fig. 9J–L) and *Archiminolia* (Herbert, 1987, fig. 209) but differs in that the lateromarginal plate is narrower and has a terminal flagellum-like projection.

The animal of a paralectotype of *B. callomphala* has unpigmented eyes (blind). On the right side is a rounded neck lobe, from which the eye stalk is not differentiated; and three epipodial tentacles, the anterior one broad with a rounded tip and projecting posteriorly from a broad membrane; middle tentacle posterior to a convoluted membrane, smallest; posterior tentacle long and slender. Left side with very small eye stalk, two small, tapered neck lobes, and three large epipodial tentacles, the anterior one separated from the posterior two by a broad epipodial lobe. The animals of the three other *Bathymophila* species examined (see below) are essentially similar, having a broad right neck lobe, two smaller left neck lobes, three well-developed pairs of epipodial tentacles, and a broad epipodial lobe between the two anterior pairs of tentacles.

There is rather smooth transition in shell morphology between *Bathymophila* species and the type species of *Archiminolia* among representatives from the New Zealand region. For example, *Archiminolia alabida* (Marshall, 1979), *A. tenuiseptum* new species, and *A. diadema* (Powell, 1937) have the umbilicus covered by an extension of the inner lip as in *Bathymophila euspira*, yet the covering is a thin, smooth, translucent septum rather than thick pad with a granular surface, and the shell is otherwise similar to the type species of *Archiminolia*. On the other hand, some apparent forms of *Bathymophila gravida* have an open umbilicus at maturity and are thus extremely similar to *Archiminolia* species. Whereas there seems little doubt that *Ethaliopsis* is a synonym of *Bathymophila* and that *Bathymophila* and *Archiminolia* are closely related to *Microgaza*, I hesitate to suggest that *Archiminolia* is a synonym of *Bathymophila* or *Microgaza* or that *Bathymophila* and *Archiminolia* might be more appropriate as subgenera of *Microgaza*. Because of these uncertainties, I accept *Bathymophila*, *Microgaza*, and *Archiminolia* as discrete genera, defined as follows: *Bathymophila*—high to low spire, narrow umbilicus infilled by heavy callus with granular structure and with one or two small bosses near base, some species with fine interstitial axial riblets on early teleoconch, lateromarginal plate (innermost marginal) with terminal flagellum; *Microgaza*—low spire, umbilicus open and very wide, externally bounded by rounded axial folds separated by incised grooves, no interstitial axial riblets on early teleoconch, lateromarginal plate broad and simple; *Archiminolia*—high to moderate spire, narrow umbilicus open or covered by a thin septum, no interstitial axial riblets on early teleoconch though fold-like axial costae present in some species, lateromarginal plate broad and lacking terminal flagellum.

Microgaza, *Bathymophila*, and *Archiminolia* species are strikingly similar to *Solariella nuda* (Dall, 1896) (Hickman and McLean, 1990, fig. 72A, 75B), the smoother forms of *S. obscura* (Couthouy, 1838) (Warén, 1993, fig. 5, 7), and some species of *Ilanga* Herbert, 1987 (Herbert, 1987) in shell morphology, the radulae of which, however, lack lateromarginal plates (see remarks on *Solariella*).

Besides the species discussed herein, the only other known members of *Bathymophila* are *Solariella micans* Dautzenberg and Fischer, 1896 (Warén, 1990, p. 180), from the northeastern Atlantic, and an undescribed western Atlantic species (J.F. Quinn, pers. comm.).

Bathymophila gravida new species
(Figures 50–53, 75, 130, 131)

Description: Shell up to 16 mm wide, wider than high, rather thick and heavy, polished, white, umbilicus filled by thick callus. Protoconch 430 μm wide, sculptured with a few fine spiral threads, tip of apical fold broadly rounded. Teleoconch up to 5.3 whorls; first whorl convex, subsequent whorls weakly convex on spire and base, periphery evenly rounded, second and third whorls with narrow horizontal sutural ramp with angulate rim. Spire on first 1.0–2.5 whorls sculptured with fine, similar spiral cords, and much finer, crowded interstitial axial riblets, 7 cords on first whorl, typically multiplying to 8–10 by intercalation, all spirals other than that at ramp rim weakening and vanishing together with riblets. On third whorl ramp rim spiral enlarging to

occupy position of former sutural ramp, with rounded nodules, cord splitting to form 2 similar cords with rounded nodules, nodules obsolete on last adult whorl. Base beside umbilical callus typically with 1 or 2 low or obsolete spiral cords with rounded nodules, nodules discrete or continuous across interspace. Umbilicus rather narrow with tightly rounded rim, outer part completely covered by thick callus with finely granulate surface, small rounded boss near abapical extremity. Aperture subcircular, outer lip thin at rim, moderately thickened within, simple, inner lip continuous with umbilical callus. Animal (alcohol, form C, NZOI U602) lacking eye pigment. Right side with flap-like neck lobe fused to eyestalk, and 3 long, slender epipodial tentacles, anterior tentacle separated from posterior 2 by broad epipodial lobe. Left side with 2 small, tapered neck lobes and 4 epipodial tentacles, anterior tentacle longest and narrowly tapered, second tentacle very small, posterior tentacles of intermediate size, second tentacle extending from edge of broad epipodial lobe between first and third tentacles. Radula (holotype, figures 130, 131) with 9 pairs of marginal teeth per transverse row, central and lateral teeth with strongly serrate cutting areas, innermost marginal with flagellum-like terminal cusp on outer edge.

Type material: Holotype H680 and 5 paratypes NZOI P1127, from type locality, 6 February 1988, R/V *Rapuhia* (U584), collected alive. Paratypes (10): N Three Kings Rise, 31°19.9′S, 173°05.1′E, 1570–1563 m, 9 February 1988, R/V *Rapuhia* (1, NMNZ M.131565; 5, NZOI U601/P1128); N Three Kings Rise, 31°30.7′S, 172°49.8′E, 1216–1385 m, 9 February 1988, R/V *Rapuhia* (2, NMNZ M.131566; 2, NZOI U602/P1123)

Type locality: N Three Kings Rise, 31°26.3′S, 172°35.6′E, 1137–1150 m.

Other material examined (25 specimens): N Three Kings Rise, 30°21.5′S, 173°08.7′E, 1474–1365 m, 7 February 1988, R/V *Rapuhia* (1 form B, NZOI U595); N Three Kings Rise, 30°32.3′S, 172°55.3′E, 1097–1082 m, 7 February 1988, R/V *Rapuhia* (2 form A, NZOI U593); N Three Kings Rise, 30°40.9′S, 173°51.5′E, 1335–1520 m, 8 February 1988, R/V *Rapuhia* (1 form A, NZOI U598); N Three Kings Rise, 31°19.9′S, 173°05.1′E, 1570–1563 m, 9 February 1988, R/V *Rapuhia* (4 form B, 8 form C, 4 form D, NZOI U601); N Three Kings Rise, 31°30.7′S, 172°49.8′E, collected alive, 1216–1385 m, 9 February 1988, R/V *Rapuhia* (1 form C, NZOI U602); S Norfolk Ridge, 34°44.1′S, 169°25.0′E, 1123–1064 m, 3 February 1988, R/V *Rapuhia* (4 form A, NZOI U571).

Distribution (Figure 75): Southern Norfolk Ridge and northern Three Kings Rise, 1082–1570 m, collected alive at 1137–1150 m (form A) and 1216–1385 m (form C) from rocky substrata with foraminiferal sand.

Remarks: *Bathymophila gravida* differs from the lectotype (the specimen figured by Schepman here selected, ZMA 3.08.049, *Siboga* station 100, Sulu Sea, 450 m) and paralectotypes of *B. callomphala* (Schepman, 1908) principally in attaining much larger size (maximum width 16 mm, cf. 6.50 mm), and in having a smaller protoconch (width 350 μm, cf. 430 μm). The shell of a paralectotype of *B. callomphala* is illustrated here (figures 56, 57, 59), and some features of the external anatomy are described above.

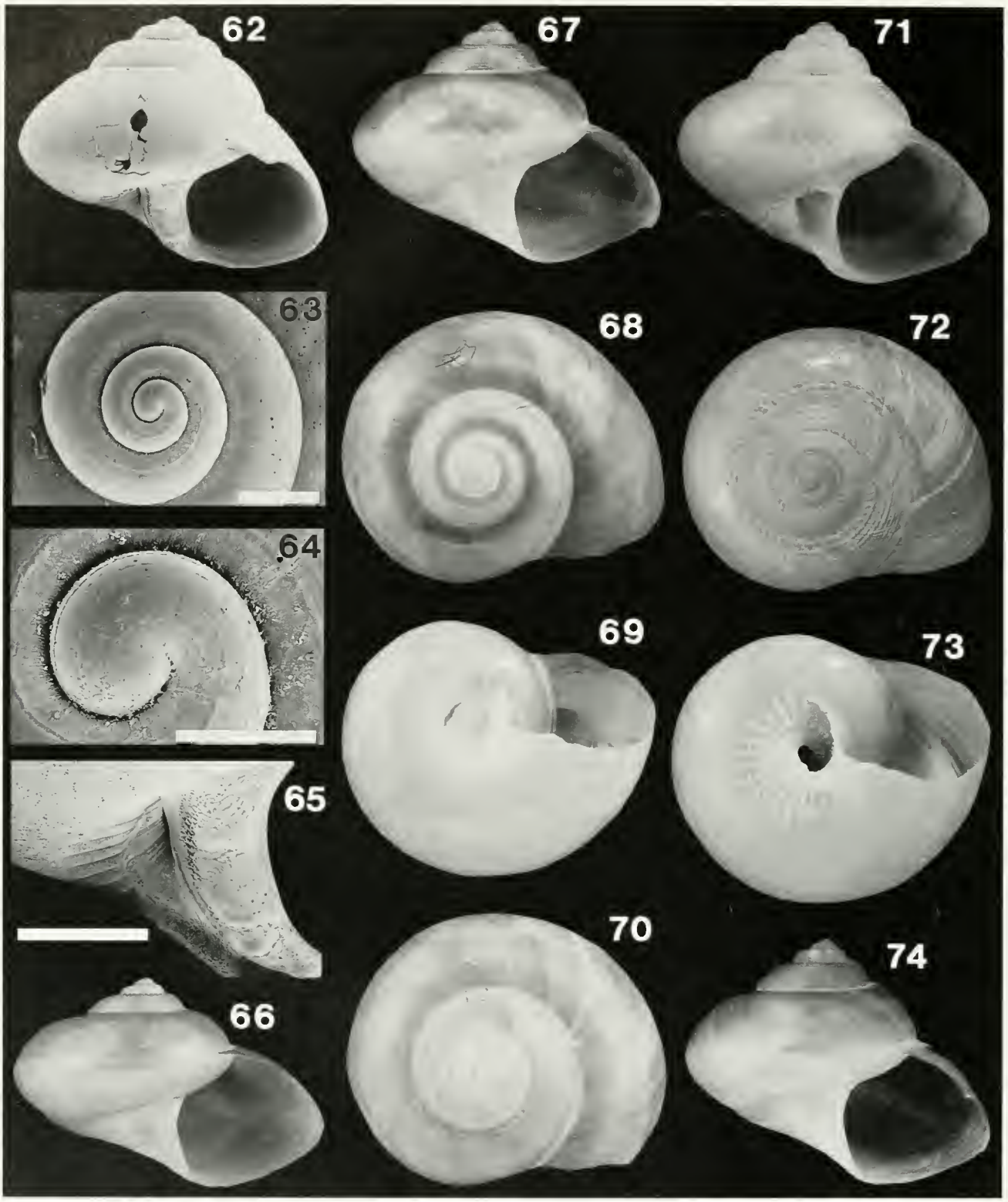
Four shell morphotypes are present in the sample from NZOI station U601: form A (7 specimens, figures 50–53, includes type material)—width up to 16 mm (est.), length/width ratio 0.72–0.88 (4 specimens), weakly convex spire whorls, two nodular subsutural spirals, one or two rows of nodules on inner base, smooth periphery, umbilicus infilled; form B (4 specimens, figures 54, 55) width up to 12 mm (est.), length/width ratio 0.88 (1 specimen), 1 nodular subsutural spiral, inner base smooth or with weak axially elongate nodules, periphery smooth, umbilicus infilled; form C (8 specimens)—width up to 12 mm, length/width ratio 0.82–0.92 (2 specimens), no subsutural or basal spirals or nodules, smooth periphery, umbilicus infilled in six specimens, open in two; form D (4 specimens)—width 14 mm, length/width ratio 0.86 (1 specimen), no subsutural or basal spirals or nodules, smooth periphery, umbilicus open, early teleoconch spirals also more persistent than in other forms. All other samples examined are form A shells with the exception of NZOI station U602, which comprises four form A and one form C with an infilled umbilicus. The single shell from station U595 resembles form B but has no nodules on the subsutural spiral. The single shell from station U598 has no spiral cord or nodules on the base but otherwise resembles form A.

Given the occurrence of additional variants at NZOI stations U602 and U598, and reports of similar variation in *B. cuspira* (Dall, 1881) by Jeffreys (1883) and Quinn (1979), I am not convinced that forms A–C represent distinct species. The status of form D is even less clear. Assuming that all specimens really are conspecific, extreme polymorphism may be due to one or more of several factors such as sexual dimorphism, influx of genetic material over time from remote sources, translocation from various depths, or differential Mayrian founder effect on waxing and waning spatially and temporarily isolated populations. Most of the shells are old and friable to varying degrees and may have accumulated in self-buffering calcareous sediments over hundreds or thousands of years. Form A, and forms B and C are strikingly similar respectively to *B. bairdi* (Dall, 1889), which is particularly variable in sculpture, and *B. cuspira*, both of which have been collected in the Yucatan Channel at 1170 meters depth (Quinn, 1979), the implication being that the latter two may likewise be forms of a single species.

Etymology: Laden, heavy (Latin).

Bathymophila valentia new species
(Figures 58, 60, 61, 75)

Description: Shell up to 8.60 mm wide, wider than high, rather thick and heavy, polished, white, umbilicus



Figures 62–74. Shells of species of *Bathymophila* and *Archiminolia*. **62–65.** *B. asphala* new species, holotype, Wanganella Bank, Norfolk Ridge, 449–442 m, NZOI H682 (4.20 × 5.15 mm). **66–70.** *A. tenuiseptum* new species, N Three Kings Rise, 790–780 m. **66, 68, 69.** Holotype, NZOI H683 (11.0 × 16.7 mm). **67, 70.** Paratype, NZOI P1124 (11.2 × 17.0 mm). **71–73.** *A. diadema* new species, holotype, Wanganella Bank, Norfolk Ridge, 757–660 m, NZOI H684 (10.0 × 12.3 mm). **74.** *A. alabida* (Marshall), holotype, Silent 1 seamount, Kermadec Ridge, 695–689 m, NZOI H255 (8.30 × 10.5 mm). Scales 63, 65 = 1 mm, 64 = 250 μm.

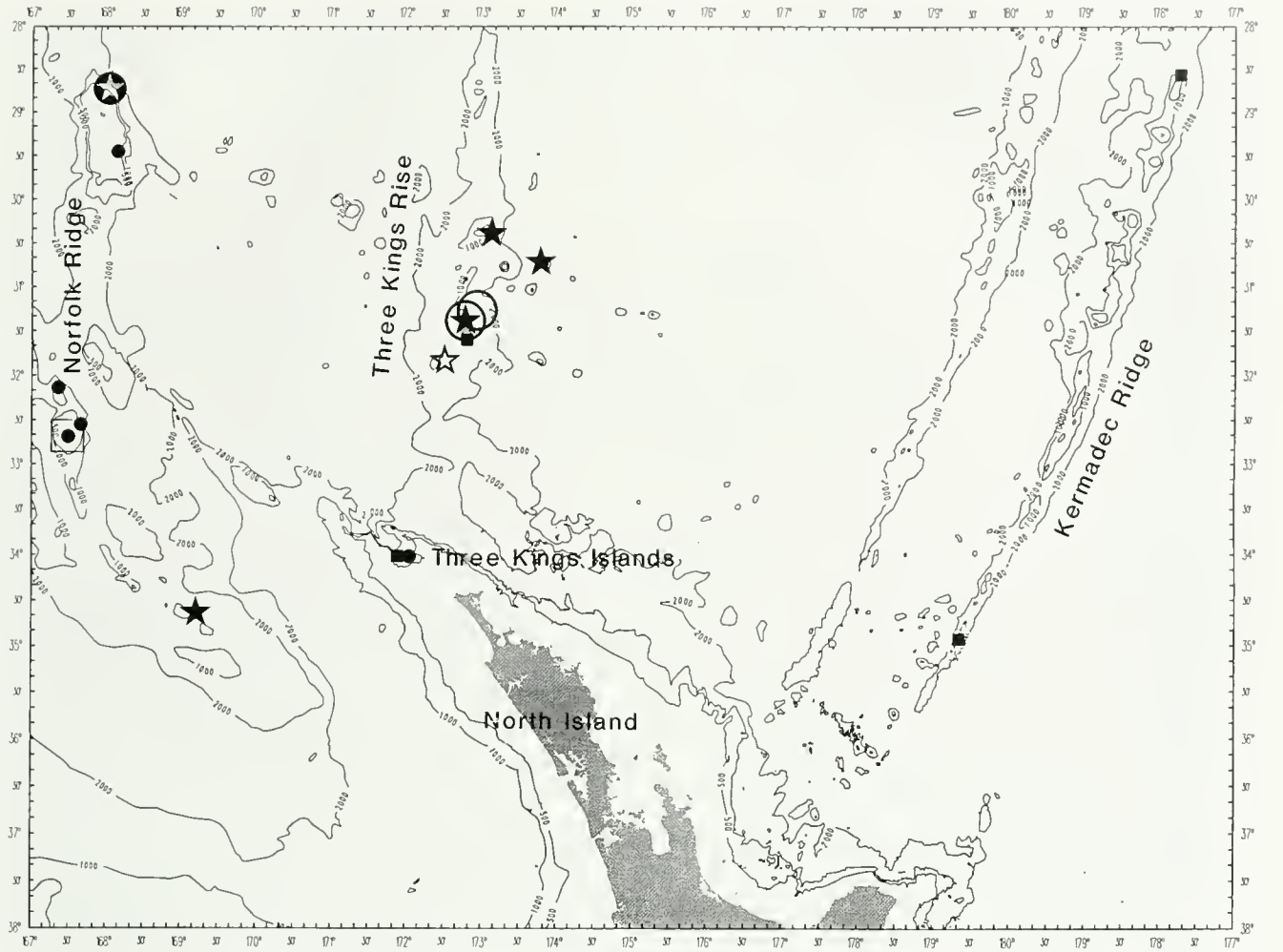


Figure 75. Map of northern New Zealand region showing distribution of species of *Bathymophila, Archiminolia,* and *Microgaza* (500, 1000 and 2000 m isobaths indicated): *B. gravida* new species (★), *B. valentia* new species (○), *A. alabida* (Marshall) (■), *B. asphala* new species (●), *A. tenuiseptum* new species (☆), *A. diadema* new species (□), *M. norfolkensis* new species (✪).

filled by thick callus. Protoconch 430 μm wide, sculpture unknown (surface etched), tip of apical fold broadly rounded. Teleoconch up to 4.8 whorls; first whorl strongly convex with narrow, horizontal sutural ramp; subsequent whorls becoming almost flat on spire; low suprasutural angulation commencing after second whorl, angulation vanishing on penultimate or last whorl in adults so that adult periphery is rounded, base weakly convex. First whorl sculptured with 2 or 3 fine, similar spiral threads, 1 on ramp, 1 on ramp rim, another beside ramp rim in 1 specimen, crisp on first whorl, obscure on second whorl; on third whorl resolving as 2 low, broad, rounded, subsutural spiral cords, eventually with rounded nodules; periphery on last adult whorl with 3 or 4 obscure or well-defined, narrow, smooth, rounded spiral cords, 1 surmounting suprasutural angulation, in some specimens another on its adapical side, 2 on outer base; base with or without row of rounded nodules at inner third, broad, smooth, rounded swelling beside umbilical rim. Umbilicus narrow though completely covered by thick callus with coarsely granulate surface, strong rounded, spirally elongate boss near abapical extremity. Aperture subcircular, outer lip thin at rim, moderately thickened within, simple, inner lip continuous with umbilical callus. Animal unknown.

Type material: Holotype NZOI H681 and 2 paratypes (1, NMNZ M.131611; 1 NZOI P1129), from type locality, 9 February 1988, R/V *Rapuhia* (U601). Paratype (1): N Three Kings Rise, 31°30.7′S, 172°49.8′E, 1216–1385 m, 9 February 1988, R/V *Rapuhia* (NZOI U602/P1130).

Type locality: N Three Kings Rise, 31°19.9′S, 173°05.1′E, 1570–1563 m.

Distribution (Figure 75): Northern Three Kings Rise, 1216–1570 m (dead).

Remarks: *Bathymophila valentia* closely resembles *B. gravida* in gross facies, differing in attaining smaller size and in being smaller relative to the number of whorls

(width up to 8.60 mm, 4.8 TW, cf. 16.0 mm, 5.3 TW) and in having a strong, rounded spiral swelling beside the umbilical rim. *Bathymophila valentia* occurred together with *B. gravida* (all empty shells) at the two stations from which it is known, and there is no indication of intergradation.

Etymology: Strength, vigor, value (Latin).

Bathymophila asphala new species
(Figures 62–65, 75)

Description: Shell up to 8.2 (est.) mm wide, wider than high, rather thick and heavy, polished, white, umbilicus filled by thick callus. Protoconch 350 μm wide, sculptured with 5 crisp, similar spiral threads, tip of apical fold broadly rounded. Teleoconch up to 4.75 whorls, first 1.5 whorls strongly convex, subsequent whorls broadly convex above and below strongly rounded periphery, suture channelled before last adult whorl. Spire on first 1.5 whorls sculptured with fine, similar spiral threads, typically multiplying by intercalation, weakening and vanishing on next half whorl. Subsequent whorls essentially smooth apart from subsutural row of low, rounded nodules on third and first half of fourth whorl; and moderate to weak, rounded axial pleats on inner third of base, umbilicus bounded by low, rounded swelling. Umbilicus rather narrow with tightly rounded rim, partly or completely covered by thick callus with finely granulate surface, 2 rounded, spirally elongate bosses near abapical extremity, another near adapical extremity. Aperture subcircular, outer lip thin at rim, moderately thickened within, simple, inner lip continuous with umbilical callus. Animal unknown.

Type material: Holotype NZOI H682 and 9 paratypes (1, NMNZ M.131612; 8, NZOI P1131), from type locality, 25 January 1977, R/V *Tangaroa* (P13). Paratype (1): Wanganella Bank, Norfolk Ridge, 32°40.8′S, 167°26.8′E, 757–660 m, 25 January 1977, R/V *Tangaroa* (NZOI P8/P1132).

Type locality: Wanganella Bank, Norfolk Ridge, 32°10.5′S, 167°21.2′E, 449–442 m.

Other material examined: SSE of Philip Island, Norfolk Island, 29°33′S, 168°07′E, 326 m, 11 July 1962, R.N.Z.F.A. *Tui* (4 juveniles, NMNZ M.224838); Wanganella Bank, Norfolk Ridge, E slope, 32°35.3′S, 167°41.8′E, 437–422 m, 29 January 1981, R/V *Tangaroa* (3 juveniles, NMNZ M.234119); N of Three Kings Islands, 34°01′S, 172°07′E, 622 m, 18 February 1974, R/V *Acheron* (fragment of adult, NMNZ M.34608).

Distribution (Figure 75): Norfolk Island, Wanganella Bank and off Three Kings Islands, 326–757 m (dead).

Remarks: *Bathymophila asphala* differs from *B. gravida* in attaining smaller size (width up to ca. 8.2 mm, cf. 16 mm), in having a smaller protoconch (width 350 μm, cf. 430 μm), and in having two bosses instead of one near the base of the umbilical callus. Though very incomplete, the shell from off the Three Kings Islands resembles the type material in protoconch size and sculpture of the umbilical callus.

Etymology: Steadfast (Greek).

Genus *Archiminolia* Iredale, 1929

Archiminolia Iredale, 1929: 170. Type species (by original designation): *Monilea oleacea* Hedley and Petterd, 1906; Recent, eastern Australia.

Remarks: As discussed above, *Archiminolia* species resemble species of *Bathymophila* and *Microgaza* in gross shell and radular morphology, differing from *Bathymophila* species in that the umbilicus is open or covered by a thin septum at maturity, in having a broad lateromarginal radular teeth without a terminal flagellum, and in having the rim of the inner lip smooth rather than granulate. They differ from *Microgaza* species in having a narrower umbilicus and a higher spire. The animal of the type species has a large left neck lobe and three large, tapered epipodial tentacles on the left side, a broad epipodial lobe between the bases of the two anterior tentacles, and a small flap in front of the anterior tentacle. On the right side are two small, tapered neck lobes, and four long, tapered epipodial tentacles. The radula of the type species was illustrated by Herbert (1987, fig. 209).

Apart from *A. oleacea* (Hedley and Petterd, 1906) and the species recorded below, other species apparently referable to *Archiminolia* include *Solariella zacalles* Melvill and Standen, 1903 (Persian Gulf); *Solariella olivaceostrigata* Schepman, 1908 and *Solariella zacalloides* Schepman, 1908 (Indonesia); and the southern Japanese species *Microgaza fulgens*, Dall, 1907, *Ethaliopsis iridescens* Habe, 1961, *Ethaliopsis katoi* Kuroda and Habe *in* Habe, 1961, *Microgaza ziczac* Kuroda and Habe *in* Kuroda, Habe and Oyama, 1971, and *Solariella* (*Microgaza*) *opalina* Shikama and Hayashi *in* Shikama, 1977. Their animals, however, are unknown, and some may prove to belong in *Ilanga* Herbert, 1987.

Archiminolia alabida (Marshall, 1979)
(Figure 74)

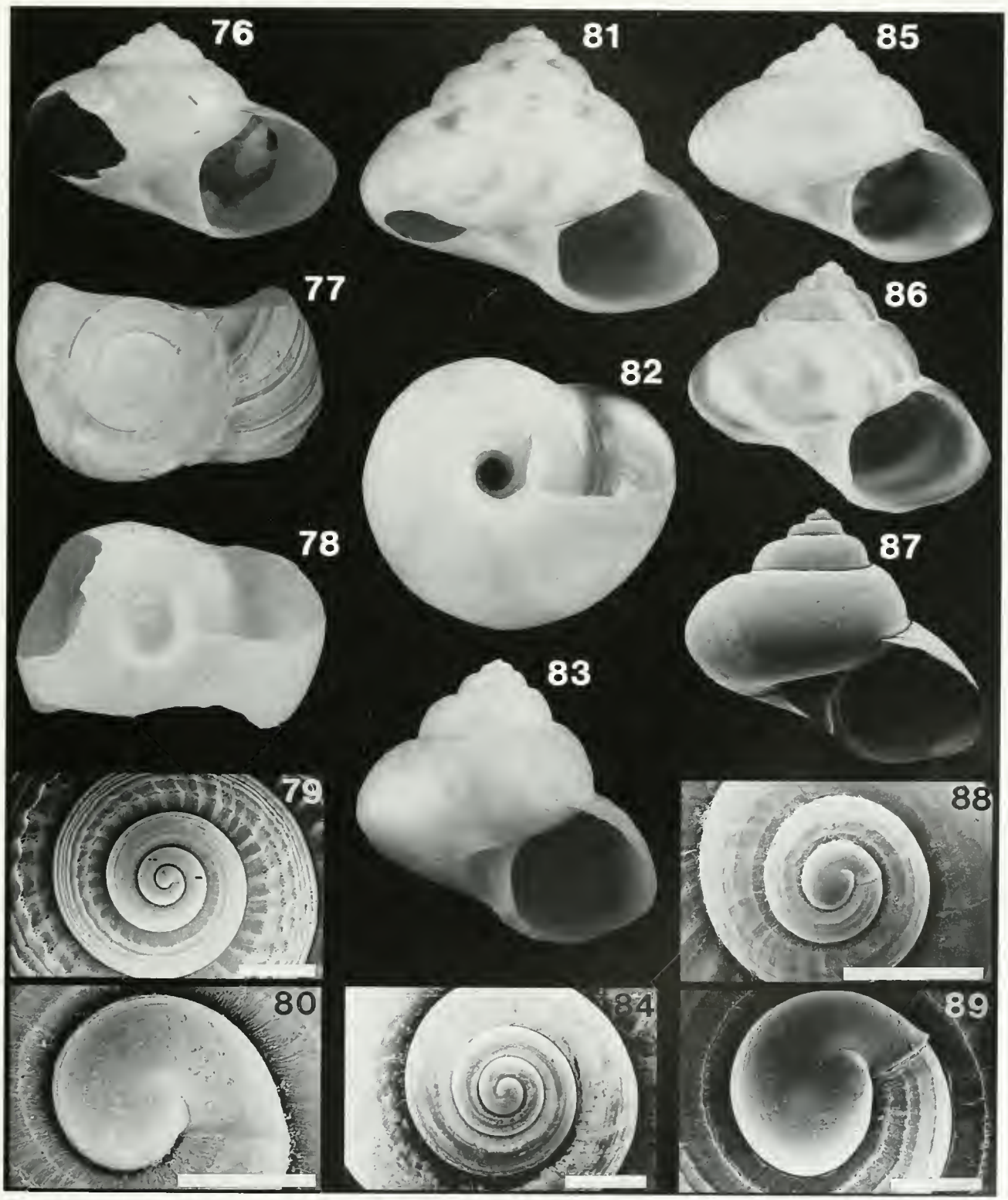
Solariella (*Microgaza*) *alabida* Marshall, 1979: 532, fig. 4K–M, 9M–O.

?*Solariella* (*Microgaza*) sp. cf. *alabida*.—Marshall, 1979: 533, fig. 5A–C.

Type material: Holotype NZOI H255, from type locality, 5 September 1974, R/V *Tangaroa* (J659), collected alive. Paratypes (2): Silent 1 seamount, 35°02.0′S, 179°15.8′E, 803-788 m, 5 September 1974, R/V *Tangaroa* (J660: 1, NMNZ M.131540; 1, NZOI).

Type locality: Silent 1 Seamount, southern Kermadec Ridge, 35°00.6′S, 179°15.1′E, 695-689 m.

Other material examined (3 specimens): N Three Kings Rise, 31°30.7′S, 172°49.8′E, 1216-1385 m, 9 Feb-



Figures 76–89. Shells of species of *Archiminolia*. **76–80.** *A. diadema* new species, paratypes, Wanganella Bank, Norfolk Ridge, 757–660 m, NZOI P1125 (76–78, 9.20 × 13.0 mm). **81.** *A. dawsoni* (Marshall), holotype, NE of Raoul Island, Kermadec Islands, 145 m, NZOI H257 (7.40 × 9.20 mm). **82, 85.** *A. oleacea* (Hedley and Petterd), N of Fraser Island, Queensland, 229–192m, AMS C.133269 (13.0 × 16.5 mm). **83, 84.** *A. episcopalis* new species **83.** Holotype, SW of Great Island, Three Kings Islands, 427 m, M.131541 (7.50 × 8.20 mm). **84.** Paratype, SW of Great Island, 440 m, M.131546. **86.** *A. hurleyi* (Marshall), holotype, NE of Raoul Island, 145 m, NZOI H256 (9.00 × 11.0 mm). **87–89.** *A. meridiana* (Dell), Taiaroa Canyon, off E Otago, 549 m, M.9055 (97–6.60 × 7.90 mm). Scales 80, 89 = 250 μm; all other figures = 1 mm.

ruary 1988, R/V *Rapuhia* (1, NZOI U602); Three Kings Trough, NW of Three Kings Islands, 34°00′S, 171°55′E, 805 m, 15 July 1962, R.N.Z.F.A. *Tui* (1, NMNZ M.59362); NE of Raoul Island, Kermadec Islands, 28°34.9′S, 177°50.0′W, 508-510 m, 26 July 1974, R/V *Tangaroa* (1, NZOI K828/2).

Distribution (Figure 75): North Three Kings Rise and Kermadec Ridge, 508-1385 m, collected alive at 689-695 m.

Remarks: *Archiminolia alabida* differs from all species of *Archiminolia*, other than two of the new species described below, in that the umbilicus is covered by a thin, translucent septum at maturity. It is transferred from *Solariella* (*Microgaza*) to *Archiminolia* rather than to *Bathymophila* because the septum is thin and smooth instead of thick and more coarsely granulate and because the lateromarginal plates lack a terminal flagellum.

A single broken shell from off Raoul Island, Kermadec Islands (Marshall, 1979, fig. 5A–C), certainly adult, is more strongly sculptured than the type specimens and lacks an umbilical septum but is otherwise similar. They may well be conspecific, because a similar degree of variation is exhibited by some other *Archiminolia* species.

Archiminolia tenuiseptum new species
(Figures 66–70, 75, 132)

Description: Shell up to 17 mm wide, wider than high, rather thin, highly polished and slippery, umbilicus covered by thin septum. Protoconch and first 2.5 teleoconch whorls translucent white; subsequent spire whorls pink with irregular darker axial bands and a narrow, white suprasutural band; base white, nacreous through translucent outer shell layer, inner lip and umbilical septum white. Protoconch 430–450 μm wide, sculptured with 2 fine, crisp spiral threads and minute granules, tip of apical fold broadly rounded. Teleoconch up to 5 convex whorls, suture channelled on first 3.5 whorls, channel rim angulate, periphery strongly convex, base weakly convex. Spire sculptured with spiral threads and rounded collabral axial folds. Spiral threads on first 3 spire whorls 6, weak or very weak, either vanishing early on fourth whorl or enlarging on third whorl, multiplying by intercalation and persisting throughout. Axial folds strongest abapically and coronating suture, gradually resolving on second or third whorl, weakening on fourth whorl and vanishing early or late on fifth whorl, entirely traversing spire on second and third whorl or third and most of fourth whorl, thereafter increasingly evanescent abapically until restricted to subsutural zone. Base at inner third with 6–8 weak spiral threads and low, rounded axial folds, elsewhere smooth apart from obscure spiral lines. Umbilicus rather narrow with tightly rounded rim, almost or entirely covered by thin translucent septum that spreads from inner lip; inner lip rim with finely granulate surface. Aperture subcircular, outer lip thin at rim, weakly thickened within, simple. Animal with pigmented eyes. Right side with broad neck lobe that is almost completely fused with eye stalk and extends to a projecting flap at the base of anterior epipodial tentacle, and 3 long, narrowly tapered epipodial tentacles, anterior 2 separated by a broad epipodial lobe. Left side with 2 small neck lobes and 3 posteriorly enlarging epipodial tentacles, bases of posterior neck lobe and anterior 2 epipodial tentacles connected by a broad membrane. Jaw plates thin; jaw elements small, strongest at anterior edge, weakening posteriorly, extending almost to posterior margin though extremely weak in posterior third. Radula typical of the genus (figure 132).

Type material: Holotype NZOI H683 and 1 paratype NZOI P1124, from type locality, 5 February 1988, R/V *Rapuhia* (U582), collected alive.

Type location: N Three Kings Rise, 31°51.7′S, 172°26.0′E, collected alive, 790–780 m.

Distribution (Figure 75): Northern Three Kings Rise, living at 780–790 m.

Remarks: *Archiminolia tenuiseptum* resembles *Archiminolia alabida* in general facies, differing in attaining larger size and in being larger relative to the number of whorls (width up to 17 mm: 5 TW, cf. 10.7 mm: 5 TW) and in having a slightly larger protoconch (width 430–450 μm, cf. 400–420 μm). *Archiminolia tenuiseptum* differs further in having a lower spire, stronger axial sculpture, and stronger sculpture on the inner base. The paratype has a strong growth scar early on the third teleoconch whorl, and it is unclear whether or not the sculptural differences on subsequent whorls between it and the holotype are due to damage to the mantle.

Etymology: Thin-walled (Latin), alluding to the umbilical septum.

Archiminolia diadema new species
(Figures 71–73, 75)

Description: Shell up to 13.5 mm wide, wider than high, rather thin, highly polished, narrow umbilicus open or covered by thin septum. Protoconch and first 3 teleoconch whorls translucent white; subsequent spire whorls pale pink with or without irregular darker axial bands and narrow, white suprasutural band; base white, nacreous through translucent outer shell layer, inner lip and umbilical septum white. Protoconch 370 μm wide, sculptured with 4 or 5 fine, crisp spiral threads, tip of apical fold broadly rounded. Teleoconch up to 5.2 whorls, all but last adult whorl with narrow, more or less horizontal sutural ramp with angulate rim, periphery and early spire whorls strongly convex, last few whorls in adults weakly convex above and below periphery. Spire sculptured with narrow but prominent spiral cords and weak, rounded collabral axial folds. Spiral cords multiplying by intercalation, 7 or 8 at end of third whorl and 9–13 at end of fourth whorl on spire, gradually weakening on mid fourth or early fifth whorl before becoming obsolete; adapical spiral at ramp rim, with prominent,

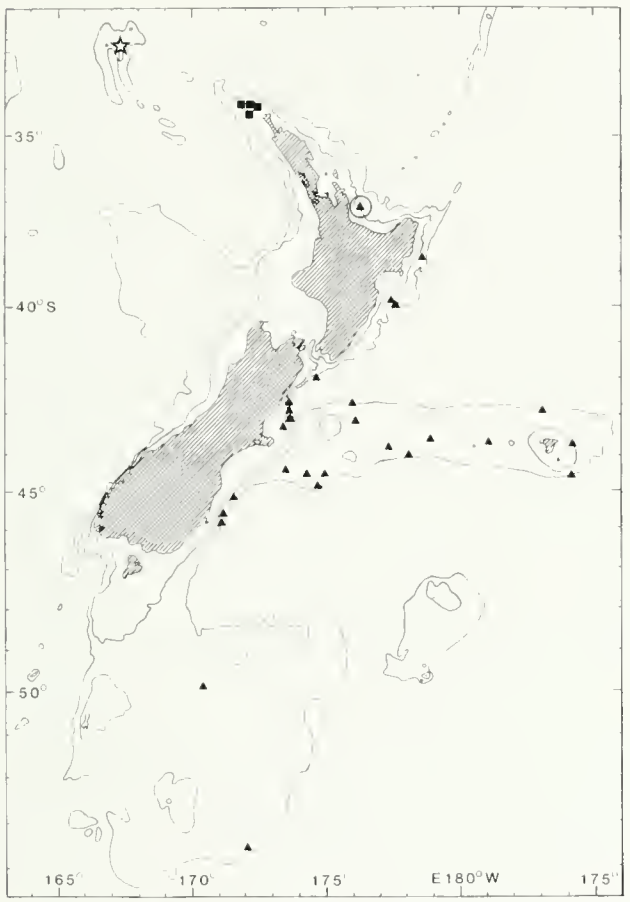


Figure 90. Map of New Zealand region showing distribution of species of *Archiminolia* (200 and 1000 m isobaths indicated): *A. wanganellica* new species (★), *A. episcopalis* new species and *A. regalis* new species (■), *A. meridiana* (Dell) (▲), and *A. diplax* new species (○).

roundly conical nodules after second whorl. Axial sculpture weak before third whorl, becoming obsolete on last adult whorl, strongest at ramp rim, weakening and vanishing abapically across spire whorls. Base with 4 or 5 rounded spiral cords at inner third, and strong, rounded axial folds, elsewhere smooth apart from obscure spiral lines. Umbilicus rather narrow with tightly rounded rim, open in juveniles, in adults open or entirely covered by thin translucent septum that spreads from inner lip, inner lip rim with finely granulate surface. Aperture subcircular, outer lip thin at rim, weakly thickened within, simple. Animal unknown (only available specimen decayed and broken into pieces during extraction).

Type material: Holotype NZOI H684 and 7 paratypes (2, NMNZ M.272597; 5, NZOI P1125), from type locality, 25 January 1977, R/V *Tangaroa* (NZOI P8), collected alive.

Type locality: Wanganella Bank, Norfolk Ridge, 32°40.8′S, 167°26.8′E, 757–660 m.

Distribution (Figure 75): Wanganella Bank, southern Norfolk Ridge, living at 660-757 m.

Remarks: *Archiminolia diadema* most closely resembles *A. alabida* and *A. tenuiseptum* in general facies. It differs from *A. tenuiseptum* and resembles *A. alabida* in size relative to the number of whorls and differs from both in having a slightly smaller protoconch (width 370 μm, cf. 430–450 μm and 400–420 μm), in that the subsutural spiral is stronger and distinctly nodular, in that the spiral and axial sculpture at the inner third of the base is much stronger, and in having paler shell coloration.

Etymology: Crown (Greek), an allusion to the strong subsutural row of nodules.

Archiminolia meridiana (Dell, 1953)
(Figures 87–90, 133)

Zeminolia meridiana Dell, 1953: 42, fig. 1, 2; Dell, 1956: 48; Dell, 1962: 75.
Spectamen meridianum.—Powell, 1976: 84; Powell, 1979: 64.

Type material: Holotype NMNZ M.5666, from type locality, 4 November 1950, R.R.S. *Discovery II*.

Type locality: Chatham Rise, 43°48′S, 178°58′W, 361 m.

Other material examined (Several hundred specimens): NE of Mayor Island, Bay of Plenty, 37°10′S, 176°23.5′E, collected alive, 732 m, 28 February 1957, M.V. *Alert* (1, M.11257); off Gable End Foreland, 38°38.7′S, 178°41.1′E, collected alive, 755–725 m, 21 January 1981, R/V *Tangaroa* (9, M.130095); off Cape Kidnappers, 39°52.8′S, 177°36.5′E, collected alive, 785-882 m, 21 January 1981, R/V *Tangaroa* (7, M.130097); off Cape Kidnappers, 39°58.55′E, 178°14.18′E, collected alive, 900 m, January 1994, F.V. *San Manukau*, coll. M.Friar (4, M.118128); off Cape Kidnappers, 39°59.7′S, 178°08.0′E, collected alive, 665 m, 7 May 1973, R/V *Tangaroa* (1 NZOI stn. G941); SE of Cape Campbell, 41°55.8′S, 174°40.7′E, 434-446m, 14 January 1979, R/V *Tangaroa* (5, M.60378); steep outer slope of Conway Ridge, S of Kaikoura, 42°37.2′S, 173°42.0′E, collected alive, 503 m, 13 January 1979, R/V *Tangaroa* (2, M.59735); NE of Mernoo Bank, W Chatham Rise, 42°38.1′S, 176°16.3′E, 980–1000 m, 11 January 1979, R/V *Tangaroa* (1, M.59581); NE of Mernoo Bank, 42°38.2′S, 176°10.5′E, collected alive, 999–984 m, 11 January 1979, R/V *Tangaroa* (3, M.59721); off Kaikoura, 42°45.2′S, 173°44.8′E, 805 m, 4 November 1979, R/V *Tangaroa* (2 NZOI stn. S213); off Chatham Islands, 42°46.59′S, 177°15.91′W, 987–996 m, 23 July 1994, F.R.V. *Tangaroa* (1, M.130101); off Waiau River mouth, S of Kaikoura, 42°55′S, 173°43′E, collected alive, 549–586 m, 18 March 1976, R/V *Acheron* (many, M.50870); Mernoo Bank, 42°59.4′S, 175°30.5′E, 112 m, 23 January 1954, M.V. *Alert* (1, M.9128); np steep wall of Pegasus Canyon, NE of Banks Peninsula, 43°14′S, 173°39′E, collected alive, 1006–512 m, 27 September 1976, R/V *Acheron* (9, M.52780); Chatham Rise, 43°14′S, 176°11′E.

collected alive, 366 m, 23 January 1954, M.V. *Alert* (10, M.130102); head of Pegasus Canyon, NE of Banks Peninsula, 43°24′S, 173°26′E, 366–311 m, 18 March 1976, R/V *Acheron* (1, M.51032); Chatham Rise, 43°32′S, 178°38′E, collected alive, ca. 549 m, 24 January 1954, M.V. *Alert* (5, M.130098); NE of Kaingaroa, Chatham Islands, 43°35′S, 176°03.5′W, collected alive, 220–229 m, 7 February 1954, M.V. *Alert* (1, M.130105); Chatham Rise, 43°38′S, 177°19′E, 531 m, 11 February 1954, M.V. *Alert* (1, M.130100); Chatham Rise, 44°04′S, 178°04′W, collected alive, 476 m, 10 February 1954, M.V. *Alert* (5, M.130099); SE of Banks Peninsula, 44°28.0′S, 174°54.8′E, collected alive, 692 m, 5 October 1979, R/V *Tangaroa* (2 NZOI stn. S143); SE of Pitt Island, Chatham Islands, 44°32′S, 176°05′W, 302 m, 3 February 1954, M.V. *Alert* (17, M.130104); SE of Banks Peninsula, 44°33.9′S, 174°51.2′E, collected alive, 750 m, 4 October 1979, R/V *Tangaroa* (5 NZOI stn. S140); SE of Banks Peninsula, 44°35.4′S, 174°49.6′E, collected alive, 785 m, 4 October 1979, R/V *Tangaroa* (13 NZOI stn. S138); SE of Pitt Island, Chatham Islands, 44°35.5′S, 176°04′W, collected alive, 604 m, 3 February 1954, M.V. *Alert* (27, M.130103); SE of Banks Peninsula, 44°50.17′S, 174°31.33′E, collected alive, 760 m, 5 October 1979, R/V *Tangaroa* (S NZOI stn. S147); head of Waitaki Canyon, off Oamaru, 45°10′S, 171°30′E, 293–256 m, 19 March 1976, R/V *Acheron* (3, M.51295); Karitane Canyon, off East Otago, 45°37.5′S, 171°06.0′E, collected alive, 476–640m, 28 March 1954, M.V. *Alert* (6, M.9136); head of Karitane Canyon, 45°38.5′S, 171°05.0′E, 585–530 m, 19 March 1976, R/V *Acheron* (1, M.51143); off East Otago, 45°45′S, 171°02′E, 520–600 m, 1980, R/V *Munida* (3, M.100609); Taiaroa Canyon, NE of Otago Peninsula, 45°45.4′S, 171°05′E, collected alive, 549 m, 16 August 1955, M.V. *Alert* (many, M.9055); Taiaroa Canyon, 45°45.6′S, 171°05′E, 549 m, 23 January 1957, M.V. *Alert* (19, M.11256); Papanui Canyon, off Taiaroa Head, 45°46′S, 171°03′E, 660 m, 1 September 1976, R/V *Munida* (19, M.58479); off Otago Peninsula, 45°50.85′S, 171°01.71′E, 555–604 m, 4 June 1992, R/V *Munida* (8, M.131531); off Otago Peninsula, 45°51.05′S, 171°00.90′E, collected alive, 500–589 m, 4 June 1992, R/V *Munida* (2, M.130745); Canyon E, off East Otago, collected alive, 421 m, 27 October 1967, R/V *Munida* (6, M.26292); off Otago Peninsula, 45°51.71′S, 171°01.78′E, collected alive, 619-550 m, 4 June 1992, R/V *Munida* (19, M.130096); between Pukaki Rise and Auckland Islands, 49°50′S, 170°14′E, collected alive, 593 m, 4 September 1978, R/V *Tangaroa* (1 NZOI stn. S16); SE of Campbell Island, 53°32.8′S, 172°16.6′E, collected alive, 580 m, 2 January 1971, R/V *Tangaroa* (1 NZOI stn. G927).

Distribution (Figure 90): North and South Island east coast, from Mayor Island to Otago Peninsula, Chatham Rise and Chatham Islands, and off Auckland and Campbell islands, 220-1000 m; collected alive at 220-999 m.

Remarks: The animal (alcohol) has on its right side a well-developed neck lobe extending from the eyestalk to the base of the first epipodial tentacle, more strongly projecting anteriorly and posteriorly; three long, narrowly tapered epipodial tentacles, and a broad, rounded epipodial lobe between the two anterior tentacles. On the left side are two neck lobes, the anterior slender, the posterior subtriangular, and three long, narrowly tapered epipodial tentacles, between which the epipodial fringe is particularly well developed. The jaw plates are well-developed. Jaw plate elements are strongest at the anterior edge and progressively weaken posteriorly. The radula (figure 133) is typical of the genus.

Following an initial spirally lirate stage, the whorls of *Archiminolia meridiana* may be entirely smooth or have a subsutural zone of rounded axial plicae that eventually weaken and vanish, with or without rounded plicae at the umbilical rim or the addition of a narrow horizontal subsutural ramp with an angulate rim; the spire axials and subsutural ramp become obsolete late on the penultimate whorl or early on the last whorl in adults. The shell may be uniform nacreous white, or the spire on the last one or two whorls may be pale pinkish buff, with or without pale axial bands, the base white below a sharp peripheral boundary. All combinations occur together and completely intergrade in several large samples. Specimens from off North Cape (NMNZ M.131559, 131562, juveniles and fragmentary adults) differ from southern shells in being more deeply pigmented, in consistently lacking subsutural axial plicae, and in having smaller protoconchs (width 470–500 μm, cf. 570–630 μm). It is unclear whether these northern specimens represent a disjunct local population of *A. meridiana* or a distinct species, and better, geographically intermediate material (if such exists) is required.

Archiminolia meridiana is not to be confused with a superficially similar though larger species (width up to 22 mm, cf. 14 mm) with a rounded instead of angulate umbilical rim, which occurs on the Bounty Platform at 705–722 meters depth and is an undescribed species of *Margarites* Gray, 1847 (Margaritinae) (NZOI stations 1684, 1685).

Archiminolia diplax new species
(Figures 90, 92–95)

Description: Shell up to 11.0 mm wide, wider than high, of moderate thickness, stout, polished, narrowly umbilicate, white. Protoconch 600 μm wide, minutely granulate and with 2 fine spiral threads, tip of apical fold broadly rounded. Teleoconch up to 5 (est.) whorls; first whorl strongly convex; subsequent whorls with narrow, sloping sutural ramp with angulate rim and pronounced suprasutural angulation; spire whorls strongly flattened between angulations; both angulations with rounded, axially elongate nodules, angulations and nodules obsolete on last adult whorl; periphery rounded, base weakly convex. First few whorls sculptured with crisp, similar spiral lirae, 7 or 8 on spire, weakening and vanishing at end of second whorl. Inner third of base with rounded axial pleats, 2 low, rounded spiral cords at umbilical rim. First

2 whorls with microsculpture of minute, crisp granules; fine collabral and spiral growth lines throughout. Umbilicus rather narrow, rim tightly rounded, wall weakly convex, with fine collabral growth lines. Aperture subcircular, outer lip thin at rim, moderately thickened within, simple, inner lip rather strongly thickened against umbilical rim. Radula unknown (only live-taken specimen is juvenile).

Type material: Holotype NMNZ M.60166, from type locality, 23 January 1979, R/V *Tangaroa*. Paratypes (5 juveniles NMNZ), SE of Aldermen Islands, 37°04.3′S, 176°26.6′E, collected alive, 807–872 m, 23 January 1981, R/V *Tangaroa* (M.75065).

Type locality: NE of Mayor Island, 37°09.1′S, 176°24.4′E, 753–826 m.

Other material examined: 1 juvenile NMNZ, E of Great Barrier Island, 36°12.0′S, 176°19.4′E, 486–655 m, 25 January 1981, R/V *Tangaroa* (M.131558).

Distribution (Figure 90): Off Great Barrier, Aldermen, and Mayor islands, 486–872 m, collected alive at 807–872 m from mud.

Remarks: This species is extremely distinctive in having a suprasutural angulation on the spire whorls, rounded, axially elongate nodules on both the submedian and subsutural angulation, and rounded axial pleats on the inner base. The sculpture of the third teleoconch whorl (where sculpture is transitional from juvenile to adult) is unknown, the type material comprising two juvenile paratypes with 1.75 and 1.8 teleoconch whorls, and the adult holotype, the first three whorls of which are decorticated.

Etymology: Double (Greek), an allusion to the two angulations on the spire.

Archiminolia episcopalis new species
(Figures 83, 84, 90)

Description: Shell up to 10.6 mm wide, wider than high, rather thin, polished, narrowly umbilicate. Protoconch and first 2.5 teleoconch whorls white, subsequent whorls pale buff with pale, irregular reddish brown axial bands that extend from suture to extreme periphery or slightly above it, sharply truncated abapically, base white. Protoconch 500 μm wide, tip of apical fold broadly rounded; sculptured with fine, crisp, crowded granules and 4 fine spiral threads. Teleoconch up to 4.6 whorls; first whorl convex, next ca. 2.5 whorls with narrow sutural ramp with angulate rim overhanging suture, ramp obsolete thereafter, below subsutural rim spire whorls and periphery rather evenly rounded, base more weakly convex. Spire on first 2–3 whorls sculptured with fine, similar spiral cords that multiply by intercalation, 8 on first whorl, typically multiplying to 12–15 before becoming obsolete, rim of sutural ramp with or without low, rounded axially elongate nodules after second whorl. Fine collabral and spiral growth lines throughout. Umbilicus rather narrow, rim tightly rounded and projecting inwards to overhang convex wall. Aperture subcircular, outer lip thin at rim, weakly thickened within, simple, inner lip strongly thickened and finely granulate against umbilical rim. Animal unknown.

Type material: Holotype NMNZ M.131541 and 2 paratypes M.131542, from type locality, 21 June 1978, R/V *Tangaroa*. Paratypes (8): Middlesex Bank, NW of Three Kings Islands, 33°59.9′S, 171°45.3′E, 186–196 m, 31 January 1981, R/V *Tangaroa* (3, M.131544); 37 km SW of Great Island, 34°20.4′S, 171°48.2′E, 440 m, 21 June 1978, R/V *Tangaroa* (4, NMNZ M.131546; 1 AMS).

Type locality: 39 km SW of Great Island, Three Kings Islands, 34°17.6′S, 171°45.3′E, 427 m.

Other material examined (38 broken or immature specimens NMNZ): 37 km NE of Great Island, Three Kings Islands, 33°58.0′S, 172°30.6′E, 550 m, 25 June 1978, R/V *Tangaroa* (2, M.131548); Middlesex Bank, NW of Three Kings Islands, 33°59.9′S, 171°45.3′E, 186–196 m, 31 January 1981, R/V *Tangaroa* (7, M.131545); Three Kings Trough, NW of Three Kings Islands, 34°00′S, 171°55′E, 805 m, 15 July 1962, R.N.Z.F.A. *Tui* (4, M.59363); 13 km N of Great Island, 34°01.8′S, 172°12.0′E, 508 m, 23 June 1978, R/V *Tangaroa* (2, M.131550); Middlesex Bank, 34°02.0′S, 171°44.0′E, 246–291 m, 31 January 1981, R/V *Tangaroa* (4, M.131551); Middlesex Bank, 34°02.1′S, 171°45.8′E, 221–206 m, 31 January 1981, R/V *Tangaroa* (1, M.131552); 22 km ENE of Great Island, 34°05.0′S, 172°24.6′E, 200 m, 24 June 1978, R/V *Tangaroa* (5, M.131553); 39 km SW of Great Island, 34°17.6′S, 171°45.3′E, 427 m, 21 June 1978, R/V *Tangaroa* (10, M.131543); 37 km SW of Great Island, 34°20.4′S, 171°48.2′E, 440 m, 21 June 1978, R/V *Tangaroa* (3, M.131547).

Distribution (Figure 90): Off Three Kings Islands, 186–805 m (dead), in comminuted Bryozoa and shell.

Remarks: Compared with *Archiminolia meridiana*, the color bands in *A. episcopalis* are stronger, the sutural ramp is outwardly adapically sloping rather than horizontal, and the axial sculpture in the subsutural zone consists of nodules rather than short costae. *Archiminolia episcopalis* differs further in having a smaller protoconch (width 500 μm, cf. 570–630 μm).

Etymology: Overseer (Latin).

Archiminolia regalis new species
(Figures 90, 96–99)

Description: Shell up to 10.3 mm wide, wider than high, sturdy, narrowly umbilicate, highly polished. Protoconch white. Ground color of first 2.5–3.0 teleoconch whorls pale yellow, last whorl white or pale greenish or dull reddish white. Second and subsequent whorls with irregular pale dull red or olive green wavy axial bands that extend from suture to about midway across base and that are interrupted over middle third of spire whorls

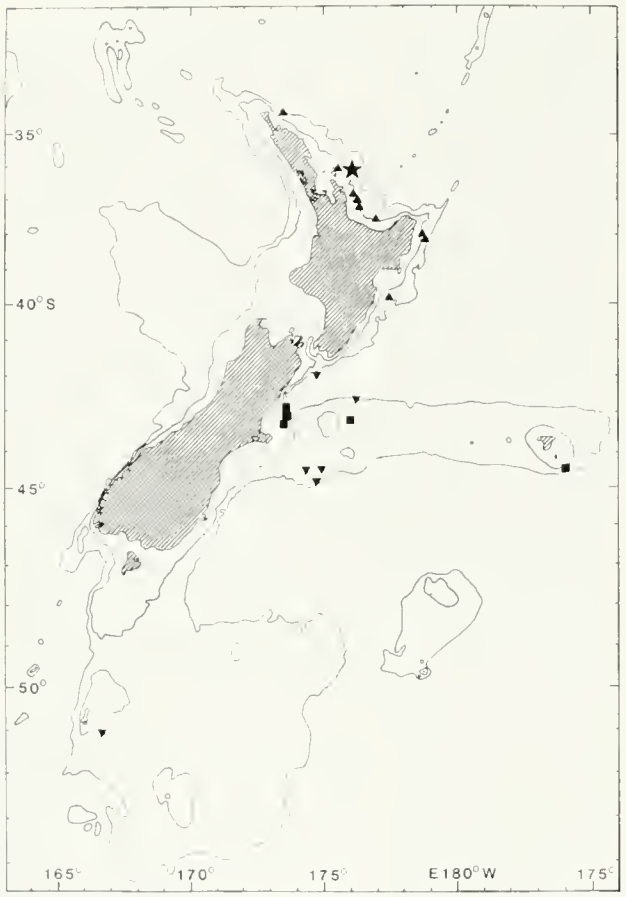


Figure 91. Map of New Zealand region showing distribution of species of *Zetela* (200 and 1000 m isobaths indicated): *Z. textilis* (Murdoch and Suter) (▲), *Z. tangaroa* new species (▼), *Z. variabilis* Dell (■), and *Z. annectens* new species (★).

and at middle of outer half of base to form more or less discrete subsutural, peripheral, and basal zones; subsutural zone and adapical extremity of peripheral zone most deeply pigmented; umbilical rim and inner lip porcellaneous white. Protoconch 500–530 μm wide, sculptured with 5 fine, crisp spiral threads and sparse granules, tip of apical fold broadly rounded. Teleoconch up to 4.5 whorls; narrow, more or less horizontal sutural ramp with tightly rounded rim; convex from ramp to umbilical rim though distinctly flattened above and below periphery. Spire on first 2 whorls sculptured with fine spiral cords that multiply by intercalation and enlarge to resemble adjacent spirals, about 20 near end of second whorl, weakening and becoming obsolete early on third whorl. Low rounded axial pleats on subsutural ramp. Fine collabral growth lines throughout. Umbilicus perspective to protoconch, rim tightly rounded, wall almost vertical, wall of each whorl shallowly concave beside rim, convex within. Aperture subcircular, outer lip thin at rim, moderately thickened within, simple, inner lip strongly thickened. Radula (optical preparation from dried animal) characteristic of the genus, lateromarginal tooth broad.

Type material: Holotype NMNZ M.131513, from type locality, 31 January 1981, R/V *Tangaroa*. Paratypes (9): Middlesex Bank, 33°59.9′S, 171°45.3′E, 186–196 m, 31 January 1981, R/V *Tangaroa* (2, M.131518); 13 km N of Great Island, Three Kings Islands, 34°01.8′S, 172°12.0′E, 508 m, 23 June 1978, R/V *Tangaroa* (1, M.131515); Middlesex Bank, 34°02.0′S, 171°44.0′E, 246–291 m, 31 January 1981, R/V *Tangaroa* (3, NMNZ M.131517; 1 AMS); off Northeast Island, Three Kings Islands, 34°08.5′S, 172°11′E, 102 m, 18 February 1974, R/V *Acheron* (2, 131514); SE of Great Island, 34°14.8′S, 172°13.6′E, collected alive, 173–178 m, 2 February 1981, R/V *Tangaroa* (1, M.131516).

Type locality: Middlesex Bank, NW of Three Kings Islands, 34°02.1′S, 171°45.8′E, 221–206 m.

Other material examined: 103 mostly immature or fragmentary specimens in 20 lots from off Three Kings Islands, NMNZ.

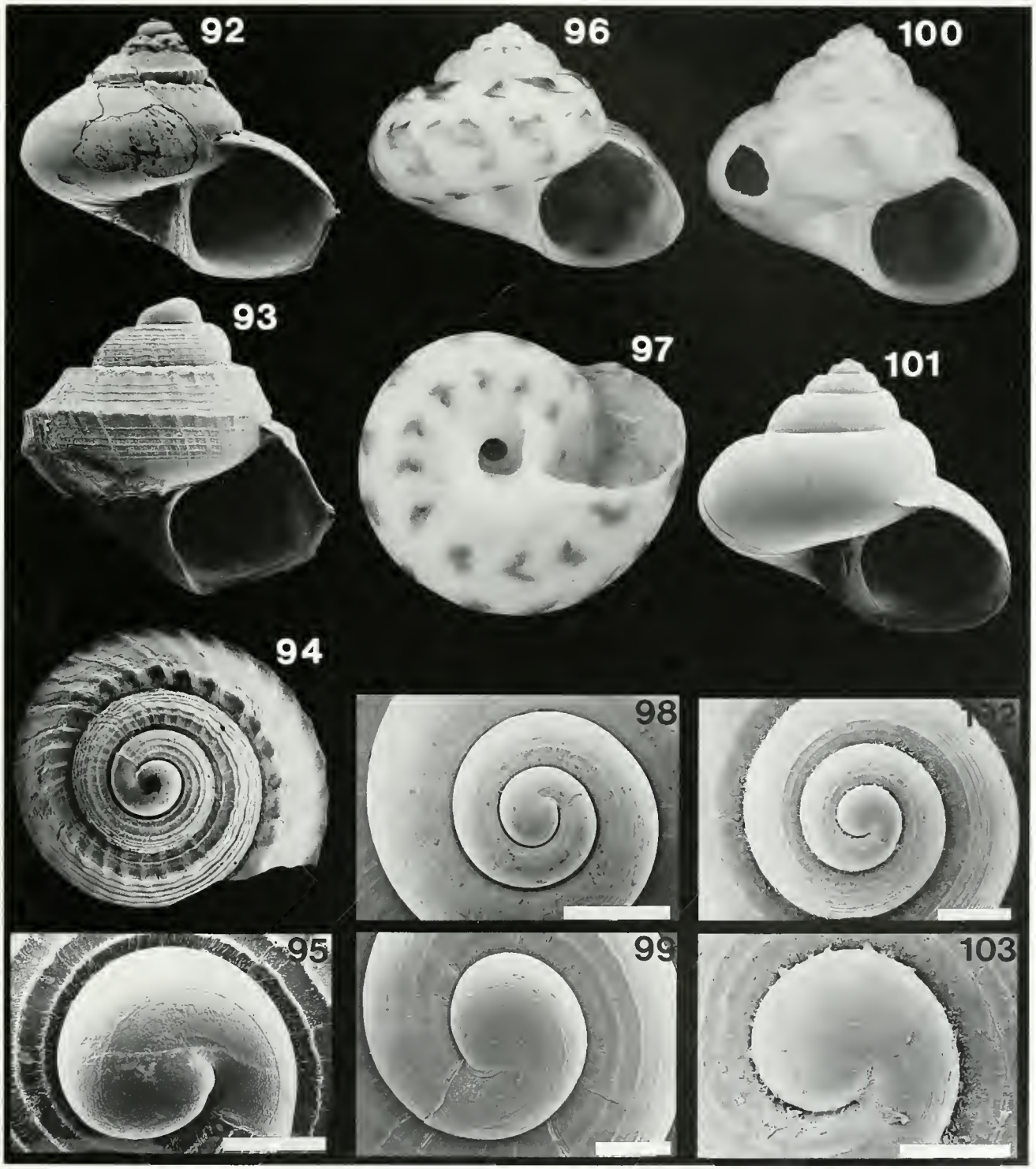
Distribution (Figure 90): Off Three Kings Islands, 91–805 m, collected alive at 173–178 m on comminuted bryozoan substratum with sponges, corals, hydroids, etc.

Remarks: *Archiminolia regalis* most closely resembles the Kermadec Ridge species *A. dawsoni* in general facies but differs principally in having a larger protoconch (width 500–530 μm, cf. 330 μm) and in being larger relative to the number of whorls (width 9.70 mm, 4.3 TW, cf. 9.10 mm, 5.2 TW). *Archiminolia regalis* is the most brightly and variably colored solarielline in the New Zealand region. A similar species occurs on Wanganella Bank, Norfolk Ridge, and is described below.

Etymology: Regal (Latin).

Archiminolia wanganellica new species
(Figures 90, 100–103)

Description: Shell up to 8.60 mm wide, wider than high, sturdy, narrowly umbilicate, highly polished and slippery. Protoconch white; first 2 teleoconch whorls very pale red; subsequent whorls white with pale yellowish brown, irregular, wavy axial bands that extend from suture or middle of spire whorls to midpoint of base, predominant green of nacreous layer showing through translucent outer shell layer; umbilical rim and inner lip porcellaneous white. Protoconch 470–480 μm wide, sculptured with about 5 fine spiral threads and minute granules, tip of apical fold broadly rounded. Teleoconch up to 4.6 whorls; second and third whorls with narrow, more or less horizontal sutural ramp with tightly rounded rim; convex from ramp to umbilical rim, weakly flattened above and below periphery. Spire on first 2 whorls sculptured with fine spiral threads that multiply by intercalation and enlarge to resemble adjacent spirals, 13–19 near end of second whorl, becoming obsolete early on third whorl. Fine collabral growth lines throughout.



Figures 92–103. Shells of species of *Archiminolia*. **92–95.** *A. diplax* new species **92.** Holotype (adult), NE of Mayor Island, 753–826 m, M.60166 (8.80 × 11.0 mm). **93–95.** Juvenile paratype, SE of Aldermen Islands, 807–872 m, M.75065 (2.50 × 2.70 mm). **96–99.** *A. regalis* new species **96, 97.** Middlesex Bank, 221–206 m, M.131513 (7.70 × 9.70 mm). **98, 99.** Paratype, off Northeast Island, Three Kings Islands, 102 m, M.131514. **100–103.** *A. wanganellica* new species, Wanganella Bank summit, 133 m. **100.** Paratype, M.131537 (7.50 × 8.30 mm). **101–103.** Holotype, M.131536 (6.20 × 6.90 mm). Scale bars 98, 102 = 500 μm. others = 250 μm.

Umbilicus perspective to protoconch, rim tightly rounded, wall almost vertical, wall of each whorl shallowly concave beside rim, convex within. Aperture subcircular, outer lip thin at rim, moderately thickened within, simple, inner lip strongly thickened.

Type material: Holotype NMNZ M.131536 and 6 paratypes (3, NMNZ M.131537; 1 AMS), from type locality, 30 January 1981, R/V *Tangaroa*, collected alive (dried).

Type locality: Summit of Wanganella Bank, Norfolk Ridge, 32°39.2′S, 167°31.7′E, 133 m.

Other material examined: Wanganella Bank, summit, 32°32.2′S, 167°30.7′E, 113 m, 29 January 1981, R/V *Tangaroa* (1 immature, NMNZ M.257230); slope of Wanganella Bank, 32°10.5′E, 167°21.2′E, 449–442 m, 25 January 1977, R/V *Tangaroa* (7, NZOI P13); Wanganella Bank, summit, 32°39.2′S, 167°31.7′E, 133 m, 30 January 1981, R/V *Tangaroa* (7 broken or immature, M.131538); Wanganella Bank, summit, 32°40.0′S, 167°33.6′E, 133 m, 30 January 1981, R/V *Tangaroa* (8 immature, NMNZ M.131602).

Distribution (Figure 90): Wanganella Bank, Norfolk Ridge, 113–449 m, collected alive at 133 m from substratum of white sand and rhodolith gravel with small red algae.

Remarks: *Archiminolia wanganellica* differs from the similar species *A. dawsoni* and *A. regalis* in protoconch size (width 470–480 μm, cf. 330 μm and 500–530 μm), and size relative to the number of whorls (width 8.60 mm, 4.6 TW, cf. 9.10 mm, 5.2 TW and 10.4 mm, 4.3 TW); it differs further from *A. regalis* in that the earliest teleoconch whorls are pale red instead of yellow.

Etymology: Named after the type locality.

Archiminolia dawsoni (Marshall, 1979)
(Figure 81)

Solariella (*Microgaza*) *dawsoni* Marshall, 1979: 533, fig. 5D–F.

Type material: Holotype (H257) and paratype NZOI, from type locality, 25 July 1974, R/V *Tangaroa* (K825).

Type locality: Kermadec Ridge, NE of Raoul Island, 28°47.8′S, 177°47.8′W, 145 m.

Distribution: Kermadec Ridge NE of Raoul Island, 145 m.

Remarks: The holotype and paratype remain the only specimens of *Archiminolia dawsoni* seen to date. Superficially similar species from off the Three Kings Islands (*A. regalis* new species) and Wanganella Bank (*A. wanganellica* new species) are described above. The protoconch of *A. dawsoni* is exceptionally small for the genus (width 330 μm).

Archiminolia hurleyi (Marshall, 1979)
(Figure 86)

Solariella (*Microgaza*) *hurleyi* Marshall, 1979: 534, fig. 5G–I.

Type material: Holotype NZOI H256, from type locality, 25 July 1974, R/V *Tangaroa* (K825).

Type locality: Kermadec Ridge, NE of Raoul Island, 28°47.8′S, 177°47.8′W, 145 m.

Distribution: Kermadec Ridge NE of Raoul Island, 145 m.

Remarks: This species is transferred from *Solariella* (*Microgaza*) to *Archiminolia* because of its general resemblance to the type species. As with *A. dawsoni*, the protoconch is unusually small among *Archiminolia* species from the southwestern Pacific (width 330 μm).

Genus *Microgaza* Dall, 1881

Microgaza Dall, 1881: 50. Type species (by original designation): *Microgaza rotella* Dall, 1881; Recent, West Indies.

Remarks: As discussed above, species of *Microgaza* resemble *Bathymophila* and *Archiminolia* species but differ from *Bathymophila* species in that the umbilicus does not become covered by a thick, granulate septum at maturity and have broad lateromarginal radular teeth without a terminal flagellum; species of *Microgaza* differ from both groups in having a wider umbilicus. The species described below is closer to the West Indian type species in shell facies than to any species here referred to *Bathymophila* or *Archiminolia*. The only other named species known from outside the Caribbean is *M. navakaensis* Ladd, 1982, described from the Pleistocene of Santo, Vanuatu, which also occurs living off southern New Caledonia (AMS C.328490, MNHN). I have examined additional, unnamed species from off Western Australia (AMS C.170029) and off Crocker Island in the Arafura Sea (AMS C.328491).

Microgaza norfolkensis new species
(Figures 75, 104–106)

Description: Shell up to 16.3 mm wide, wider than high, thin, widely umbilicate, highly polished. Protoconch and first 2.5 teleoconch whorls white; next 1.5 whorls pinkish buff, last half whorl white with narrow, irregular wavy axial band on spire, base white. Protoconch 400 μm wide, tip of apical fold broadly rounded. Teleoconch up to 5 whorls, first 2 whorls strongly convex, subsequent whorls more weakly convex on spire and base, periphery strongly convex. Spire on first 2 whorls sculptured with 6 crisp spiral threads, interspaces wider than each thread, rapidly becoming obsolete thereafter; numerous fine, crowded, rounded spiral threads commencing on fourth whorl, crisp on spire and periphery, more weakly defined on base; low, rounded axial costae commencing about midway through second whorl, entirely traversing spire whorl at first, progressively enlarg-

ing and becoming obsolete abapically to form subsutural zone of rounded axial pleats, becoming obsolete on first half of third whorl or late on fourth whorl. Inner quarter of base and umbilical rim with close, rounded axial pleats separated by grooves. Umbilical rim strongly angulate, surmounted by rounded spiral cord, umbilical wall evenly and moderately convex, sculptured with crisp spiral lirae and collabral growth lines. Umbilicus perspective to protoconch. Aperture ovate, lips thin at rim, weakly thickened within, simple. Animal unknown.

Type material: Holotype NZOI H685 and paratype NMNZ M.131567, from type locality, 30 January 1977, R/V *Tangaroa* (P45).

Type locality: Off Norfolk Island, 28°42.0′S, 167°57.8′E, 527–508 m.

Distribution (Figure 75): Off Norfolk Island, 527–508 m (dead).

Remarks: *Microgaza norfolkensis* is strikingly similar to the tropical western Atlantic species *Microgaza rotella* (Dall, 1881) in general facies but differs in attaining more than twice the size (width up to 16.3 mm, cf. 6.80 mm), in having a larger protoconch (width 400 μm, cf. 330–350 μm), in having a more broadly rounded periphery, and in having stronger spiral lirae on the last adult whorl. *Microgaza navakaensis* Ladd, 1982, from the Pleistocene of Santo, Vanuatu, differs in being smaller relative to the number of whorls and in having a color pattern of crowded, wavy axial bands (Ladd, 1982, pl. 34, fig. 1–5).

Genus *Zetela* Finlay, 1926

Zetela Finlay, 1926: 359. Type species (by original designation): *Minolia textilis* Murdoch and Suter, 1906; Recent, New Zealand.

?*Lamellitrochus* Quinn, 1991: 81. Type species (by original designation): *Margarita lamellosa* Verrill and Smith, 1880; Recent, eastern North America.

Remarks: The type species of *Zetela* is distinctive in having strong, reticulating spiral and axial sculpture and crisp granules on the teleoconch and in not having the innermost marginal modified to form a lateromarginal plate (figures 134–138). The animal of *Zetela textilis* (preserved material, NMNZ M.58797) has a broad, rounded neck lobe on the right side connected to the eyestalk, a tiny tentaculiform neck lobe below the left eyestalk, and four epipodial tentacles on each side, the anterior and posterior pairs long and slender, the middle pairs minute. The periostracum is apparently calcified (intritacalx) in all species, though as in *Solariella* (short of examination of cross sections of fractured shells), its presence is only revealed by the effects of solution etching in a few species.

The southern African species *Solariella intermissa* Thiele, 1925 (Herbert, 1987, fig. 115—"rnl" and "lnl" are transposed) and the closely related species Z. *kopua* new species differ from Z. *textilis* in having an extra (posterior) neck lobe on the left side but are otherwise similar. Like Z. *textilis*, both species lack lateromarginal plates in the radula, though unlike Z. *textilis*, the tooth that gives rise to it has a reduced cutting area. According to Quinn's (1991) composite description of the external anatomy, species of *Lamellitrochus* Quinn, 1991, have two left neck lobes and three epipodial tentacles on each side, the middle one long or short. The condition in the type species (*Margarita lamellosa* Verrill and Smith, 1880) was not specified, though from study of preserved material kindly lent by J.F. Quinn, there are actually four pairs of epipodial tentacles, the two middle pairs much smaller as in Z. *textilis*. All of these Atlantic species resemble Z. *textilis* in having strong axial sculpture, at least on the early teleoconch, a protoconch with a bulbous tip and fine spiral threads, and a teleoconch microsculpture of minute granules. The type species and most other species referred to *Lamellitrochus* by Quinn (1991) differ markedly from Z. *textilis* in that the later spire whorls are more weakly convex and sculptured with three angulating primary spiral cords (abapical spiral more or less covered by succeeding whorls). Differences in shell morphology between *L. lamellosus* and Z. *textilis*, however, are bridged via *L. fenestratus* Quinn, 1991, *L. carinatus* Quinn, 1991, *L. bicoronatus* Quinn, 1991, and *Zetela variabilis* Dell, 1956. Since *Lamellitrochus* and *Zetela* species also have similar external anatomies and radulae, it seems likely that *Lamellitrochus* is a synonym of *Zetela*. A New Zealand *Zetela* species resembling Atlantic *Lamellitrochus* species is described below.

The shells of *Zetela textilis* and *Lamellitrochus lamellosus* are similar to the *affinis* form (figure 40) and the holotype (Warén, 1993, fig. 2A), respectively, of *Solariella amabilis* (Jeffreys, 1865), in which, however, lateral four is relatively larger and the innermost marginal has been transformed into a broad lateromarginal plate (Warén, 1993, fig. 7B), and there are three pairs of similar epipodial tentacles and a rounded flap-like structure between the two anterior pairs of epipodial tentacles. As discussed above, *S. amabilis* apparently belongs in *Solariella sensu stricto*.

Zetela textilis (Murdoch and Suter, 1906)
(Figures 91, 109, 110, 134)

Minolia textilis Murdoch and Suter, 1906: 298, pl. 26, fig. 45, 46.

Monilea (Minolia) textilis.—Suter, 1913: 143, pl. 33, fig. 14, 14a.

Zetela textilis.—Finlay, 1926: 359.

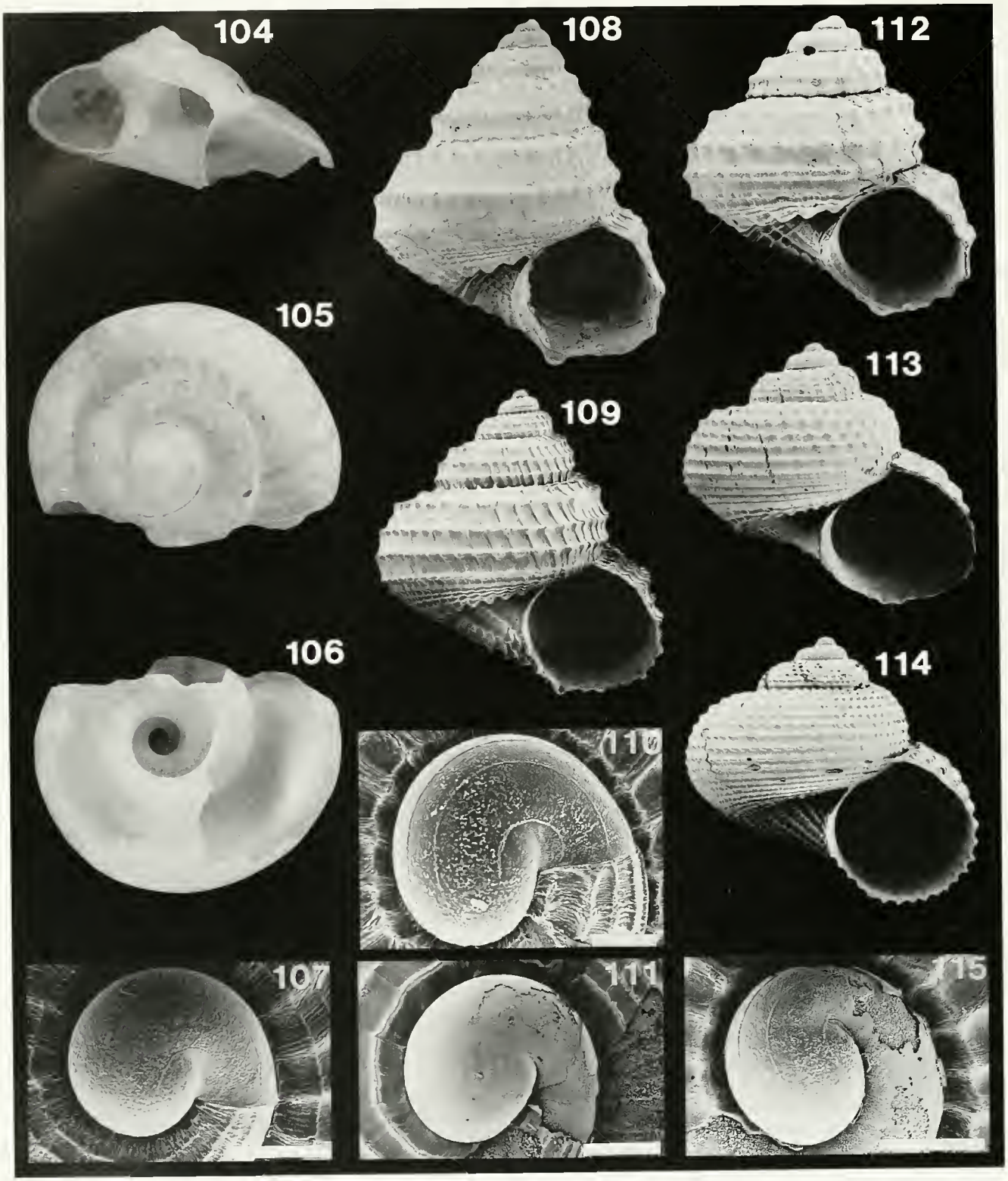
Isanda (Zetela) textilis.—Wenz, 1938: 318, fig. 720.

Solariella (Zetela) textilis.—Keen, 1960: 262, fig. 167/1; Powell, 1974: 207; Powell, 1979: 64, pl. 17, fig. 20.

Type material: Holotype NMNZ M.1123, from type locality, S.S. *Awarua*.

Type locality: Off Great Barrier Island, 36°08′S, 175°55′E, 201 m, 22 January 1904.

Other material examined (ca. 1000 specimens



Figures 104–115. Shells of species of *Microgaza* and *Zetela*. **104–106.** *Microgaza norfolkensis* new species, holotype, off Norfolk Island, 527–508 m, NZOI H685 (16.3 × 7.00 mm). **107, 112, 113.** *Zetela variabilis* Dell. **107, 113.** Pegasus Canyon, NE of Banks Peninsula, 1006–512 m, M.52779 (107, juvenile; 113, 4.35 × 4.90 mm). **112.** Pegasus Canyon, 256–293 m, M.94763 (4.65 × 4.70 mm). **108.** *Zetela annectens* new species, holotype, off Great Barrier Island, 486–655 m, M.137596 (5.80 × 5.05 mm). **109, 110.** *Zetela textilis* (Murdoch and Suter). **109.** SE of The Aldermen, 178–248 m, M.65154 (4.35 × 4.30 mm). **110.** Off Mayor Island, 256–311 m, M.35478. **111, 114.** *Zetela tangaroa* new species, holotype, SE of Banks Peninsula, 760 m, NZOI H686 (4.75 × 5.55). **115.** *Zetela kopua* new species, paratype, N Bounty Trough, 1373 m, NZOI P1126. Scale bar 110 = 120 μm, others = 250 μm.

NMNZ): E of North Cape, 34°25.0′S, 173°13.1′E, collected alive, 327–257 m, 27 January 1981, R/V *Tangaroa* (71, M.131497); SE of Aldermen Islands, 37°00.8′S, 176°12.3′E, collected alive, 178–248 m, 23 January 1979, R/V *Tangaroa* (many, M.65154); SE of Aldermen Islands, 37°01.0′S, 176°14.8′E, collected alive, 357–312 m, 24 January 1981, R/V *Tangaroa* (1, M.131498); NNW of Mayor Island, 37°08.7′S, 176°14.2′E, 356–380 m, 23 January 1979, R/V *Tangaroa* (2, M.61047); NW of Mayor Island, 37°09.6′S, 176°12.2′E, 293–348 m, 22 January 1979, R/V *Tangaroa* (1, M.61028); NW of Mayor Island, 37°11.5′S, 176°10.0′E, collected alive, 198–273 m, 22 January 1979, R/V *Tangaroa* (35, M.66560); off Mayor Island, 37°12′S, 176°17′E, collected alive, 256–311 m, 9 February 1974, R/V *Acheron* (9, M.35478); SE of Mayor Island, 37°21.9′S, 176°20.9′E, collected alive, 203–248 m, 22 January 1979, R/V *Tangaroa* (3, M.61319); off Mayor Island, Bay of Plenty, 37°22.5′S, 176°22′E, 207–220 m, 27 February 1957, M.V. *Alert* (10, M.12868); N of Motuhora Island, 37°35.1′S, 176°59.5′E, collected alive, 248–213 m, 20 January 1979, R/V *Tangaroa* (6, M.65022); N of Motuhora Island, 37°37.8′S, 176°59.9′E, collected alive, 129–139 m, 20 January 1979, R/V *Tangaroa* (21, M.67785); ENE of Tokomaru Bay, 37°59.7′S, 178°40.0′E, collected alive, 144 m, 16 January 1979, R/V *Tangaroa* (43, M.59846); ENE of Tolaga Bay, 38°15.2′S, 178°38.6′E, collected alive, 139 m, 16 January 1979, R/V *Tangaroa* (29, M.59797); SE of Cape Kidnappers, 39°55.5′S, 177°30′E, 183 m, 20 May 1952, M.V. *Kotuku* (1, M.8748).

Distribution (Figure 91): North Island east coast, from North Cape to Cape Kidnappers, 129–380 m; collected alive at 139–327 m from mud.

Remarks: *Zetela textilis* attains 5.60 mm in width, is uniform translucent white, and has a highly distinctive sculpture of prominent axial lamellae that are narrowly and sharply angulate in section and strong, rounded spiral cords, with sharply nodular intersections on the spire and at the umbilical rim.

Zetela variabilis Dell, 1956
(Figures 91, 107, 112, 113)

Zetela variabilis Dell, 1956: 48, fig. 70, 74.
Solariella (*Zetela*) *variabilis*.—Powell, 1976: 84; Powell, 1979: 64.

Description: Shell up to 5.75 mm wide, wider than high or about as high as wide at maturity, of moderate thickness, umbilicate, white. Protoconch 530–570 μm wide, tip of apical fold broadly rounded; sculptured with fine, crisp, irregular granules, and 3 fine, crisp spiral threads. Teleoconch up to 3.60 whorls, first whorl rather evenly convex; subsequent whorls convex below angulation at rim of gently sloping subsutural ramp, base distinctly flattened, umbilical rim angulate. Sculptured with rounded spiral cords and strong, rounded axial costae. Spiral cords numbering 5 or 6 at end of first whorl, abapical spiral either fully exposed throughout or almost covered by succeeding whorls; on subsequent whorls all spirals strong and similar, or 1 or 2 on side of spire may vanish on second whorl then reappear later at varying stages in the same positions, these remaining weaker than adjacent spirals, 4–7 on adult penultimate whorl, and 3–9 on base; rounded nodules at intersections with axial costae, strong on spire, strongest at umbilical rim, of intermediate strength on other spirals, nodules at umbilical rim less numerous than axials on spire. Axial costae strong on spire and at umbilical rim, almost obsolete on outer base, evanescent over outer umbilical wall. First whorl with microsculpture of numerous fine, crisp axial threads, weakening and vanishing early on next whorl. Umbilicus funnel-shaped, narrow within, rim moderately angulate; outer part of wall of last whorl almost flat, convex within, sculptured with inwardly weakening spiral cords and axial riblets. Aperture subcircular, lips thin at rim, moderately thickened within, simple. Animal (alcohol, NMNZ M.65164) with broad flap-like neck lobe on right side fully fused with eyestalk, 1 small tentaculiform left neck lobe, and 4 epipodial tentacles on each side; anterior and posterior tentacles on left side long and slender, middle 2 minute; anterior tentacle and posterior 2 tentacles on left side long and slender, anterior second tentacle much smaller. The radula (optical preparation) is similar to that of *Z. textilis*.

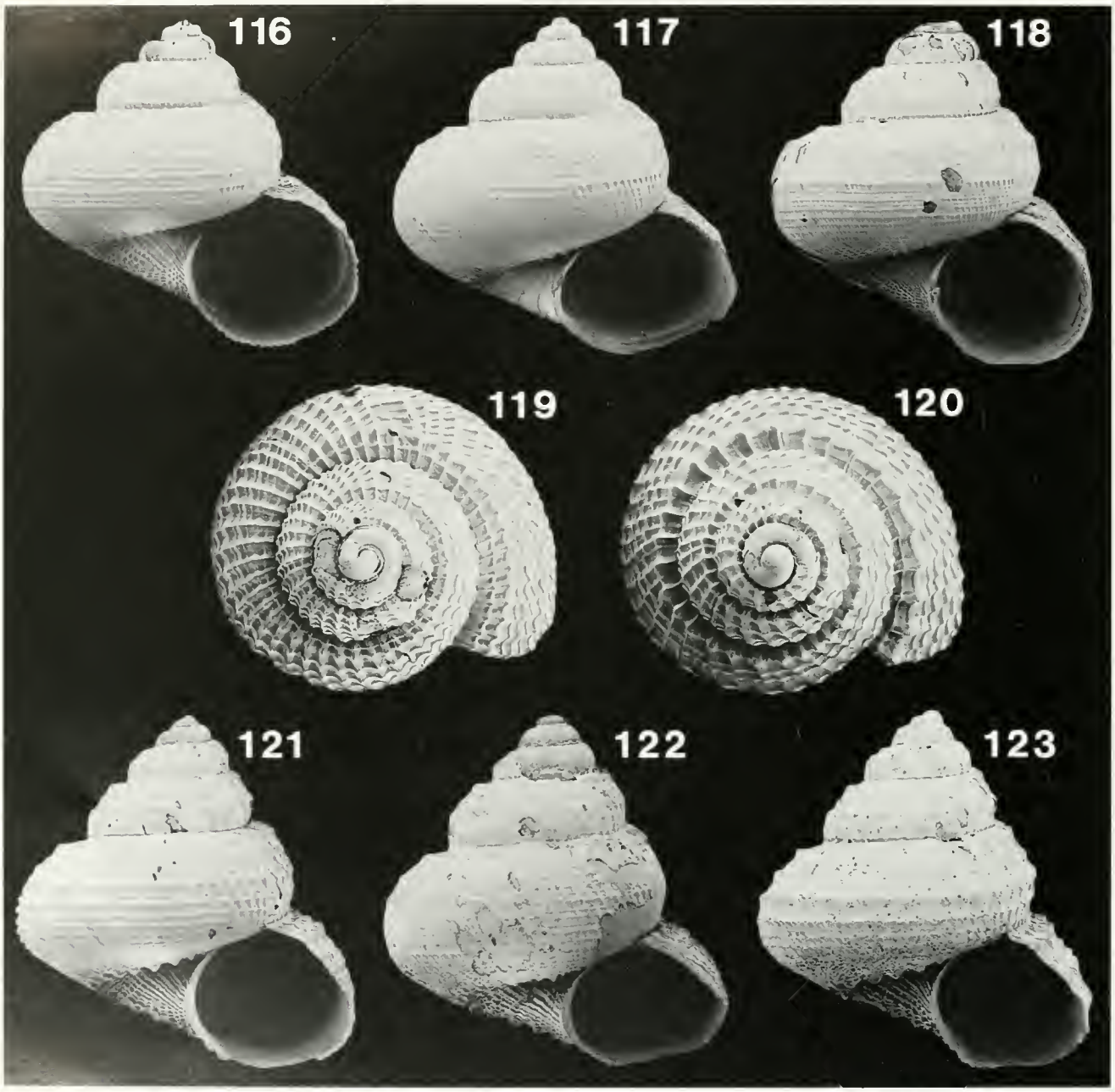
Type material: Holotype NMNZ M.9768, from type locality, 3 February 1954, M.V. *Alert*.

Type locality: SE of Pitt Island, Chatham Islands, 44°32′S, 176°05′W, 284 m.

Other material examined (40 specimens NMNZ): Off Waiau River mouth, S of Kaikoura, 42°55′S, 173°43′E, 549–586 m, 18 March 1976, R/V *Acheron* (6, M.50888); up steep wall of Pegasus Canyon, NE of Banks Peninsula, 43°14′S, 173°39′E, collected alive, 1006–512 m, 27 September 1976, R/V *Acheron* (15, M.52779); Pegasus Canyon, NE of Banks Peninsula, 43°25.0′S, 173°26.0′E, collected alive, 485–476 m, 21 February 1979, R/V *Acheron* (2, M.65164); Pegasus Canyon, 43°31.0′S, 173°30.5′E, 256–293 m, 21 February 1979, R/V *Acheron* (15, M.94763); Chatham Rise, 43°14′S, 176°11′E, 366 m, 23 January 1954, M.V. *Alert* (1, M.10839); SE of Pitt Island, Chatham Islands, 44°32′S, 176°05′W, 284 m, 3 February 1954, M.V. *Alert* (1, M.10838).

Distribution (Figure 91): Off Banks Peninsula and Chatham Islands, and Chatham Rise, 256–1006 m; collected alive at 476 m and 512–1006 m from mud with shell and/or coral.

Remarks: *Zetela variabilis* resembles *Z. textilis* in size and in being translucent white, but differs principally in that the axial costae on the spire whorls are broadly rounded in section instead of sharply and narrowly angulate. The original specimens of *Zetela variabilis* are all



Figures 116–123. *Zetela kopua* new species. **116.** Holotype, N Bounty Trough, 1386 m, holotype NZOI H687 (9.00 × 9.50 mm). **117.** N Three Kings Rise, 1570–1563 m, NZOI U601 (9.10 × 9.35 mm). **118.** S Lord Howe Rise, 2417–2421 m, NZOI U226 (10.0 est. × 9.40 mm). **119.** Paratype, N Bounty Trough, 1373 m, NZOI P1126 (width 4.70 mm). **120–122.** S Lord Howe Rise, 1573 m, NZOI U198 (120, width 4.60 mm; 121, 6.80 × 6.50 mm; **122,** 8.30 (est.) × 7.85 mm). **123.** S Lord Howe Rise, 1186 m, NZOI U197 (7.85 × 7.35 mm).

juveniles [illegible] 2.5 × 2.70 mm, 2.5 teleoconch whorls), and the species is redescribed from adult material. It is aptly named, for adults prove to have exceptionally variable sculpture. Despite the great differences between the extremes (figures 112, 113), none of the differences are constant and it seems clear that all represent a single highly polymorphic species.

Zetela annectens new species
(Figures 91, 108)

Description: Shell (holotype) up to 5.80 mm high, slightly higher than wide at maturity, of moderate thickness, umbilicate, chalky white (lightly solution etched). Protoconch about 500 μm wide, tip of apical fold broad-

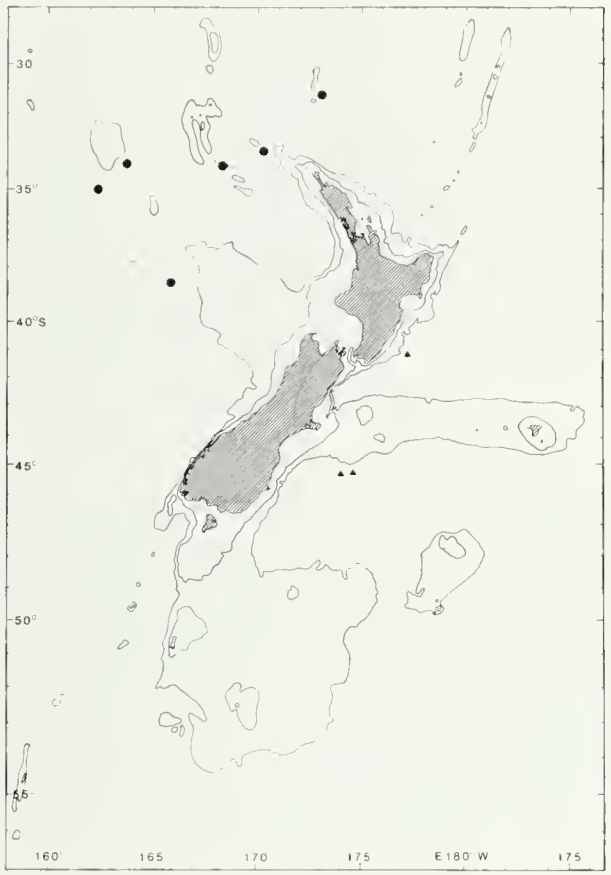


Figure 124. Map of New Zealand region show distribution of *Zetela kopua* new species (200 and 1000 m isobaths indicated).

ly rounded, sculpture unknown (surface and rim etched away). Teleoconch up to 4.5 whorls, first whorl rather evenly convex; subsequent whorls with gently sloping sutural ramp with strongly angulate rim, weakly convex above and below angulate periphery, umbilical rim angulate. Sculptured with rounded spiral cords and narrow, more or less collabral axial riblets, rounded conical nodules at intersections. Earliest whorls eroded but with at least 4 spiral cords, spiral 2 (numbering abapically) becoming obsolete on third whorl; cords on subsequent whorls numbering 3 on spire and 4 on base. Spire spirals at shoulder angulation, submedially and at periphery, strongly nodular; submedian and peripheral spirals strongest and similar, summit of peripheral spiral exposed on spire; basal spirals similar, more weakly nodular than spire spirals. Axial riblets traversing spire and base, evanescent within umbilicus, with increasing shell size increasing numbers intercalating between shoulder angulation and umbilical rim, so that number of nodules on spirals between shoulder spiral and umbilical rim becomes about 3 times greater than on shoulder spiral and umbilical rim. Umbilicus deep, funnel-shaped, angulate rim with strong, roundly conical nodules; wall convex, sculptured with 3 spiral threads on outer part and axial riblets. Aperture subcircular, lips thin at rim, weakly thickened within, inner lip with moderate median angulation, separated from outer lip by strong basal angulation. Animal unknown (shell of holotype too fragile to risk extraction).

Type material: Holotype NMNZ M.137596 and 1 juvenile paratype M.137597, from type locality, 25 January 1981, R/V *Tangaroa*, collected alive.

Type locality: E of Great Barrier Island, 36°12.0′S, 176°19.4′E, collected alive, 486–655 m.

Distribution (Figure 91): Off Great Barrier Island, 486–655 (alive), in mud with foraminiferans and coral.

Remarks: *Zetela annectens* is strikingly similar to western Atlantic species referred to *Lamellitrochus* by Quinn (1991), from all of which it differs, however, in having only 4 spiral cords on the base and no secondary spiral sculpture on the last few adult whorls.

Etymology: Linking, joining (Latin), an allusion to similarity to Western Atlantic species.

Zetela kopua new species
(Figures 115, 116–124, 135, 136)

Description: Shell up to 14.2 mm wide, slightly wider than high, thin, rather narrowly umbilicate, translucent white. Protoconch 600–620 μm wide, tip of apical fold broadly rounded; sculptured with fine, crisp, irregular granules and 3 fine, crisp spiral threads. Teleoconch up to about 5 whorls, first whorl evenly convex; subsequent whorls with narrow horizontal sutural ramp defined by angulate rim, strongly and rather evenly convex from ramp rim to suture within umbilicus. Reticulately sculptured with narrow, crisp spiral cords that multiply by intercalation and enlarge to resemble adjacent spirals and crisp, collabral axial riblets that are about as strong as spirals, interspaces wider than each spiral and axial, intersections finely beaded, spirals and axials roundly angulate in section. Axials continuous on first 2 whorls; thereafter strongest on and close beside subsutural ramp, increasing numbers of additional axials intercalating at irregular intervals in broad zone between abapical side of ramp rim and inner third of base, so that eventually there are about twice as many axials as in subsutural zone and on inner third of base. Spiral cords numbering 6 or 7 on first whorl, abapical spiral more or less covered by succeeding whorls, 19–25 on adult penultimate whorl. Umbilicus funnel-shaped, narrow within, rim evenly rounded; wall of last whorl evenly convex, sculptured as on base. Aperture subcircular, lips thin at rim, weakly thickened within, simple. Animal (alcohol, NZOI stn S154) with broad, rounded right neck lobe, 2 small tentaculiform left neck lobes, and 4 epipodial tentacles on each side, anterior and posterior pairs long and slender, median pair much smaller, eyes pigmented. Radula (figures 135, 136) with the formula ca. 6 + 4 + 1 + 4 + ca. 6. Central and lateral teeth stout with

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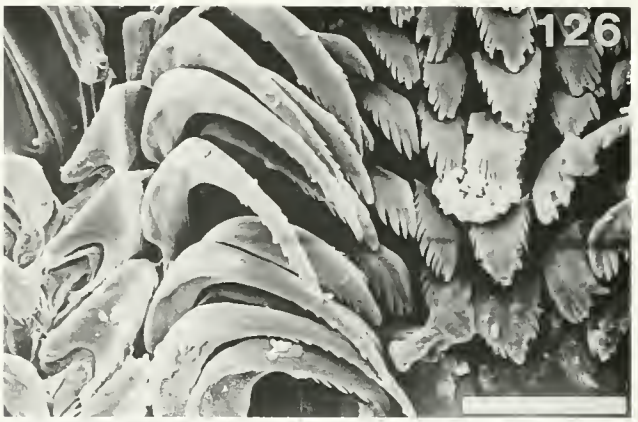
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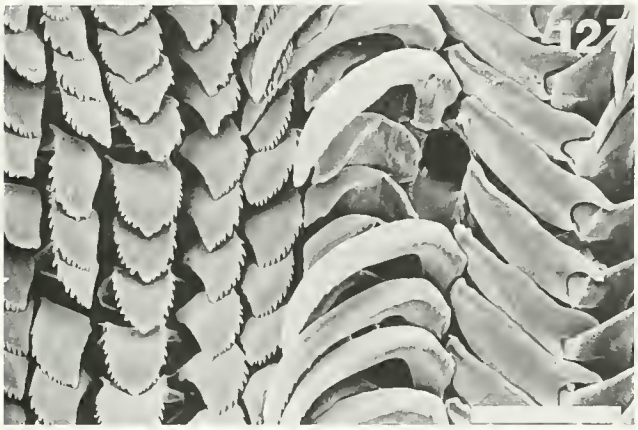
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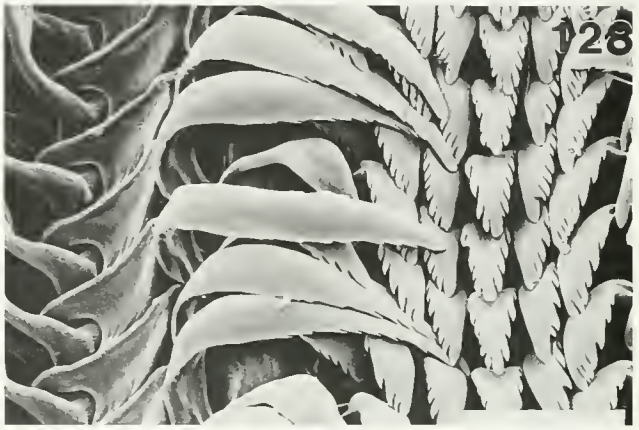
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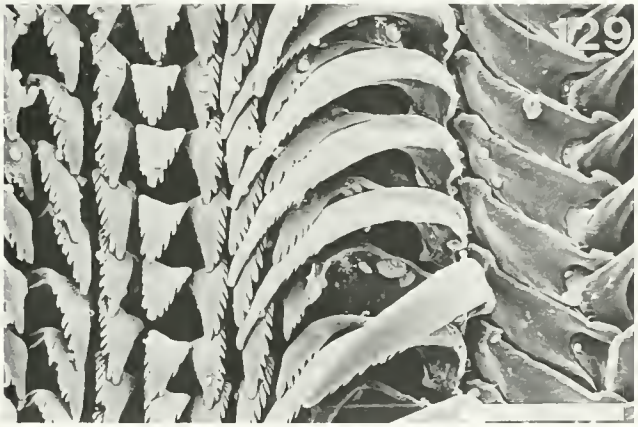
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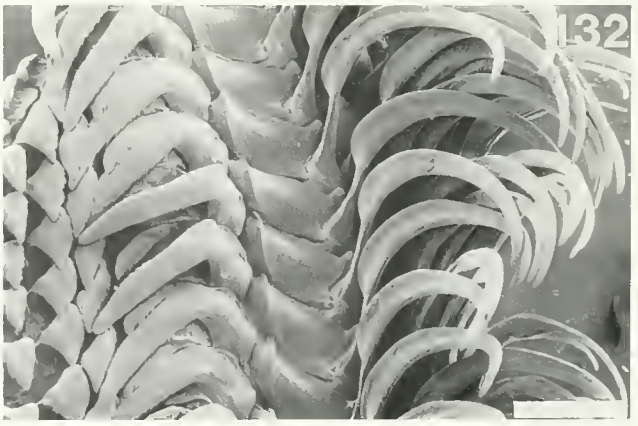
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strongly flanged and grooved interlocking bases, laterals 1–3 outwardly elongating but with cutting areas outwardly decreasing in size, lateral 4 considerably longer. Cutting areas narrowly tapered, serrate on central tooth, outer edges (only) serrate on lateral teeth, terminal cusp on each strongest, that on lateral 4 longest. Marginal teeth slender, terminal cusp very long and slender, a tiny cusp on outer edge at about distal quarter.

Type material: Holotype NZOI H687 and 13 paratypes (3, NMNZ M.131532; 10, NZOI P1133), from type locality, 27 October 1979, R/V *Tangaroa* (S153), collected alive. Paratypes (12): Bounty Trough, E of Oamaru, 45°24.2′S, 173°59.8′E, collected alive, 1373 m, 27 October 1979, R/V *Tangaroa* (2, NMNZ M.131533; 10, NZOI S154/P1126).

Type locality: Bounty Trough, E of Oamaru, 45°21.1′S, 173°35.8′E, 1386 m.

Other material examined (20 specimens): N Three Kings Rise, 31°19.9′S, 173°05.1′E, 1570–1563 m, 9 February 1988, R/V *Rapuhia* (1, NZOI U601); Norfolk Ridge, 34°05′S, 168°10′E, S 1488–1556 m, 20 March 1968, M.V. *Taranui* (1, NZOI E870); Lord Howe Rise, SE of Lord Howe Island, 34°59.3′S, 162°11.21′E, collected alive, 1573 m, 26 September 1982, R/V *Tangaroa* (2, NMNZ M.131535; 3, NZOI U198); Lord Howe Rise, SE of Lord Howe Island, 34°09.8′S, 163°36.7′E, 1186 m, 25 September 1982, R/V *Tangaroa* (1, NMNZ M.137598; 4, NZOI U197); Lord Howe Rise, SE of Lord Howe Island, 38°37.3′S, 165°36.0′E, 2417–2421 m, 16 October 1982, R/V *Tangaroa* (1, NMNZ M.131534; 3, NZOI U226); Hikurangi Trench, off Castlepoint, 41°11.9′S, 177°19.6′E, collected alive, 2200–2328 m, 18 June 1980, R/V *Tangaroa* (3, NZOI P971).

Distribution (Figure 124): Southern Lord Howe Rise, southern Norfolk Ridge, northern Three Kings Rise, southern Hikurangi Trench, and northern Bounty Trough, 1186–2421 m, living at 1373–2328 m in mud and foraminiferal ooze.

Remarks: Specimens from the Lord Howe Rise differ from specimens from southeastern New Zealand in having a submedian angulation on the spire, an angulate umbilical rim, and stronger, more widely spaced axial costae on the early teleoconch whorls, on the subsutural zone on later whorls, and at the umbilical rim (figures 116–123). Specimens from 2417–2421 meters depth on the Lord Howe Rise differ from specimens from both southern New Zealand and shallower depths on the Lord Howe Rise (1186–1573 m, figures 120–123) in having two low angulations that divide the spire whorls into thirds. The single shell from the northern Three Kings Rise (figure 117) has an angulate umbilical rim, a weak supramedian angulation, an extremely weak submedian angulation, only a single spiral cord on the umbilical wall, and a larger protoconch (width 700 μm, cf. 600–620 μm) and considerably weaker axial costae on the early teleoconch whorls than in specimens from either Lord Howe Rise or southern New Zealand. The single incomplete shell from the southern Norfolk Ridge has evenly convex whorls, an angulate umbilical rim, and numerous spirals on the umbilical wall. Given the distances between Lord Howe Rise, northern Three Kings Rise and southeastern New Zealand and the fact that the populations are not significantly isolated by bathymetry, I am not convinced that distinct species are involved and assume that the various forms are local populations of a single polymorphic species and that morphologically and geographically intermediate populations may eventually be discovered.

Forms of *Z. kopua* from the Lord Howe Rise are strikingly similar to *Trochus* (*Margarita*) *rhina* Watson, 1886 (syntypes BMNH 1887.2.9.302–10), from bathyal and abyssal depths in the northeastern Atlantic, but *T. rhina* differs in having a smaller protoconch (width 500 μm, cf. 600–620 μm) and a rounded angulation on the umbilical wall, against which the inner lip is much thicker and roundly angulate. Specimens of *T. rhina* were well illustrated by Dautzenberg and Fischer (1896, pl. 20, fig. 15–17) and Dautzenberg (1927, pl. 5, fig. 35–37), who misidentified them as *Solariella cincta* (Philippi, 1836), an entirely different species (Warén, 1993, figs. B, C, E). Lord Howe Rise specimens are also similar to *S. intermissa* Thiele, 1925, from off southern Africa at 340–1280 meters depth (Herbert, 1987), but Lord Howe Rise and New Zealand specimens differ in having a larger protoconch (width 600–620 μm, cf. 450–500 μm) and a thinner inner lip. *Trochus rhina*, *S. intermissa*, and *Z. kopua* obviously belong in the same species group. Other possible congeners are *Solariella delicata* Dall, 1919 (holotype USNM 205780- Kosuge, 1972, pl. 2, fig. 6) and similar northwestern Pacific species described by Bagirov (1995), all of which differ from *Z. rhina*, *Z. intermissa*, and *Z. kopua*, however, in that axial riblets are not added by intercalation between the subsutural zone and the umbilical rim and in other sculptural details. Bagirov (1995) did not describe the animals or illustrate the marginal teeth of his species but did state that all of the marginal teeth are similar, so it would seem that they lack lateromarginal plates.

←

Figures 125–132. Radulae of species of *Solariella* and *Bathymophila*. **125.** *Solariella plicatula* (Murdoch and Suter), off Poor Knights Islands, 121–113 m, M.35876. **126.** *S. vera* (Powell), Middlesex Bank, 221–206 m, M.130063. **127.** *S. lutcola* (Powell), Middlesex Bank, 221–206 m, M.130055. **128.** *S. benthicola* (Powell), Middlesex Bank, 221–206 m M.130079. **129.** *S. peristicta* new species, King Bank, 128–123 m, M.131494. **130, 131.** *Bathymophila gravida* new species, ex holotype, N Three Kings Rise, 1137–1150 m. **132.** *B. tenuiseptum* new species, ex holotype, N Three Kings Rise, 790–780 m. Scales 125–129 = 50 μm, 130–132 = 100 μm.

Figures 133–138. Radulae of species of *Archiminolia* and *Zetela*. **133.** *Archiminolia meridiana* (Dell), off Cape Kidnappers, 900 m, M.118128. **134.** *Zetela textilis* (Murdoch and Suter), off Mayor Island, 256–311 m, M.35478. **135, 136.** Z. *kopua* new species, ex holotype, Bounty Trough, E of Oamaru, 1386 m. **137, 138.** Z. *tangaroa* new species, NE of Mernoo Bank, Chatham Rise, 999-984 m, M.39727. Scale 135 = 100 μm, others = 50 μm.

Etymology: Deep (Maori).

Zetela tangaroa new species
(Figures 91, 111–114, 137, 138)

Description: Shell up to 7.80 mm wide, slightly wider than high, thin, rather narrowly umbilicate, translucent white. Protoconch 630 μm wide, obscurely and minutely granulate, a fine spiral thread beside suture, tip of apical fold broadly rounded, bulbous. Teleoconch up to 4.0 whorls, strongly and rather evenly convex from suture on spire to suture within umbilicus. Sculptured with prominent crisp spiral cords that multiply by intercalation and enlarge to resemble adjacent spirals, and weak collabral axial riblets, intersections with well-developed nodules after first whorl, nodules on spire roundly conical on second whorl, roundly conical or becoming fully rounded on next whorl; nodules on adult base rounded

and weaker than on spire, roundly conical and as strong as on spire on umbilical wall. Spiral cords numbering 7 on first whorl, abapical spiral more or less covered by succeeding whorls, 10 on adult penultimate whorl, interspaces wider than each spiral. Axials fold-like on spire on first 1.5 whorls, thereafter almost obsolete on spire and base, though strong on umbilical wall. Umbilicus funnel-shaped, narrow within, rim evenly rounded, wall of last whorl evenly convex, strongly sculptured. Aperture subcircular, lips thin at rim, weakly thickened within, simple. Animal (alcohol, NZOI stn. S147) with broad, rounded right neck lobe and small tapered left neck lobe, 4 epipodial tentacles on each side, anterior and posterior pairs long and slender, middle pairs minute. Radula (figures 137, 138) with the formula ca. 6 + 4 + 1 + 4 + ca. 6. Central and lateral teeth stout with strongly flanged and grooved, interlocking bases, laterals 1–3 outwardly elongating but with cutting areas outwardly decreasing in size, lateral 4 considerably longer and with longer cutting area. Cutting areas narrowly tapered, serrate on central tooth, outer edges (only) serrate on lateral teeth, terminal cusp on each strongest. Marginal teeth slender, terminal cusp very long and slender, below which up to 6 minute cusps, fewer on outer teeth.

Type material: Holotype NZOI H.686 and 8 paratypes (2, NMNZ M.131536; 6, NZOI P1136), from type locality, 25 October 1979, R/V *Tangaroa* (S147), collected alive. Paratypes (10): SE of Cape Campbell, 42°00.8′S, 174°41.0′E, 939–1019 m, 14 January 1979, R/V *Tangaroa* (1, M.60436); NE of Mernoo Bank, W Chatham Rise, 42°38.2′S, 176°10.5′E, collected alive, 999–984 m, 11 January 1979, R/V *Tangaroa* (2, M.59727); SE Banks Peninsula, 44°46.67′S, 174°91.33′E, collected alive, 692m, 5 October 1979, R/V *Tangaroa* (2, NZOI S143/P1134); SE Banks Peninsula, 44°59.00′S, 174°82.67′E, collected alive, 785m, 4 October 1979, R/V *Tangaroa* (5, NZOI S138/P1135).

Type locality: SE of Banks Peninsula, 44°30.1′S, 174°18.8′E, 760 m.

Other material examined: Off Auckland Islands, 51°10′S, 166°37′E, 490–510 m, 31 October 1994, F.V. *Petersen*, coll. M. Marinovich, found alive amongst sample of cirrate octopods from bottom trawl (1, M.131554).

Distribution (Figure 91): Off western Chatham Rise, 692–1019 m, and off Auckland Islands, 490–510 m; collected alive at 490–999 m from foraminiferal mud.

Remarks: Compared with *Zetela variabilis*, which it most closely resembles, *Z. tangaroa* differs principally by having a larger protoconch, weaker axial sculpture, and in lacking a basal angulation.

Etymology: Named after R/V *Tangaroa*.

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The Authorship and Status of Type Specimens of *Urocoptis alleni* and Three Species of *Cerion* from Cuba (Gastropoda: Urocoptidae and Ceriidae)

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ABSTRACT

Urocoptis alleni, *Cerion paucicostatum*, *Cerion alleni*, and *Cerion victor* (Urocoptidae and Ceriidae) are pulmonate gastropods from Cuba whose names were introduced solely in plate captions. Although usually attributed to Torre, 1929, all four are Torre manuscript names introduced by Pilsbry, 1929. Problems with lectotype designations for these names are addressed as is the status of supposed type material in several U.S. museums.

Key words: Pulmonata, Urocoptidae, Ceriidae, *Tetrentodon*, Pilsbry, Torre, Cuba.

INTRODUCTION

During the preparation of the second part of a type catalog of mollusks in the American Museum of Natural History (e.g., Boyko & Sage, 1996), questions arose about the type status of specimens of *Urocoptis alleni* (now placed in *Tetrentodon*, Urocoptidae), as well as *Cerion paucicostatum*, *Cerion alleni*, and *Cerion victor* (Ceriidae) and the authorship of those names. These names were introduced in a plate caption in *The Nautilus* (1929, 42(3), pl. 4; figure 1, herein), and, although attributed to [Carlos de la] Torre, we suspected they should be attributed to Henry A. Pilsbry, who was then editor of the journal. Although many authors continue to use the name Cerionidae Pilsbry, 1901, because of its long-standing usage, we use Ceriidae Fleming, 1818, as it is the technically correct form of the family name.

Torre created many manuscript names, as pointed out by Clench and Turner (1962:3–4), who stated that "it is exceedingly unfortunate that Carlos de la Torre had given actually hundreds of names to species or subspecies which were never described. Many Cuban collectors have sold or exchanged a vast number of specimens under these manuscript names." Pilsbry (1929d:449) also noted one occasion when Torre stated that he had "given unpublished names" to species Pilsbry had under study. Welch (1934), in naming *Cerion ramsdeni*, wrote "the expected description not being received from Dr. Torre, I am here describing it under his name." Also, a manuscript catalog of landshells by M. K. Jacobson (1949–1957: entry 8633) at AMNH lists *Urocoptis alleni* as "Torre MS." Jacobson was knowledgeable about the taxonomy of Cuban land snails, and his notation suggests that Pilsbry used an unpublished Torre manuscript name for this species. The wherabouts of Torre's manuscript(s) containing these names, or if any such manuscript ever existed, is unknown. Since the contents of the type series in such cases can depend on who authored the names, we investigated further.

Acronyms:

AMNH	Department of Invertebrates, American Museum of Natural History, New York;
ANSP	Department of Malacology, Academy of Natural Sciences of Philadelphia, Pennsylvania;
DMNH	Delaware Museum of Natural History, Wilmington;
FMNH	Field Museum of Natural History, Chicago, Illinois;
ICZN	International Code of Zoological Nomenclature;
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts;
USNM	Department of Invertebrate Zoology, United States National Museum (now National Museum of Natural History), Smithsonian Institution, Washington, D.C.

AUTHORSHIP OF NAMES

The question of authorship for *Urocoptis alleni* and the three "Torre" *Cerion* species introduced in The Nautilus (1929, 42(3), pl. 4, figs. 7–13; figures 7–13, herein) arises because no article by Torre appeared in volume 42 of that journal. His name is not listed in the index to that volume or La Rocque's (1963) author index for the journal. There is no indication that Torre was the author of the plate captions other than his name appearing after those of the species. The names were not marked as new nor described; only locality data were given.

Partial descriptions of *Urocoptis alleni* were given by Pilsbry (1929c:141) and Jaume and Torre (1972:1530), but no full description of the species has been published to date, presumably because the species is "muy característica, no pudiendo confundirse con ninguna otra" (Jaume and Torre, 1972:1530). A written description of *Cerion victor* was published by Clench and Aguayo (1952:417, 419) and *C. alleni* has been described under three different synonymous names (see Clench, 1957: 133). *Cerion paucicostatum* has not been described as such, although a subspecies, *C. p. harringtoni* Aguayo and Sánchez Roig, 1953, has been described (see Richardson, 1992:78). However, these names are available from the original publication in *The Nautilus* (1929, 42(3), pl. 4, figs. 7–13) because ICZN Article 12(b)(7) allows names introduced before 1931 to be accompanied only by an illustration.

Cuban *Caracolus* illustrated on the same plate as the four taxa in question (pl. 4, figs. 1–6, and figures 1–6, herein) were treated by Pilsbry (1929a) in the same issue of the journal, but he did not mention the *Urocoptis* or *Cerion* species. In the next issue, however, Pilsbry (1929c: 141), cited the figure of *Urocoptis alleni*, gave its radular formula and remarked on its similarity to *U. plicata* [= *Tetrentodon plicatus* (Pfeiffer, 1856)] and *U. scalarina* [= *T. scalarina* (Shuttleworth, 1852)]. Pilsbry's authorship of both articles (1929a and 1929c) that cite plate 4 suggests that he prepared the plate and is responsible for the availability of the names introduced therein. As editor of *The Nautilus*, Pilsbry often combined figures from several articles on one plate to save space. For example, Pilsbry (1929a:80), stated "To complete Plate 5 a few Cuban shells collected by Mr. d'Alte A. Welch and the writer in northwestern Camagney are figured." Perhaps he neglected to mention at the same point that he had completed plate 4 with figures of *U. alleni*, to be treated in the next issue, and several Cuban *Cerion*

Since evidence from *The Nautilus* was not fully conclusive for determining authorship of these four species, external evidence was sought. We turned to four sources: the published work of subsequent authors, the labels for supposed components of the type series at AMNH, ANSP, DMNH, FMNH, MCZ, and USNM, catalog entries for specimens at ANSP, and the ANSP archives.

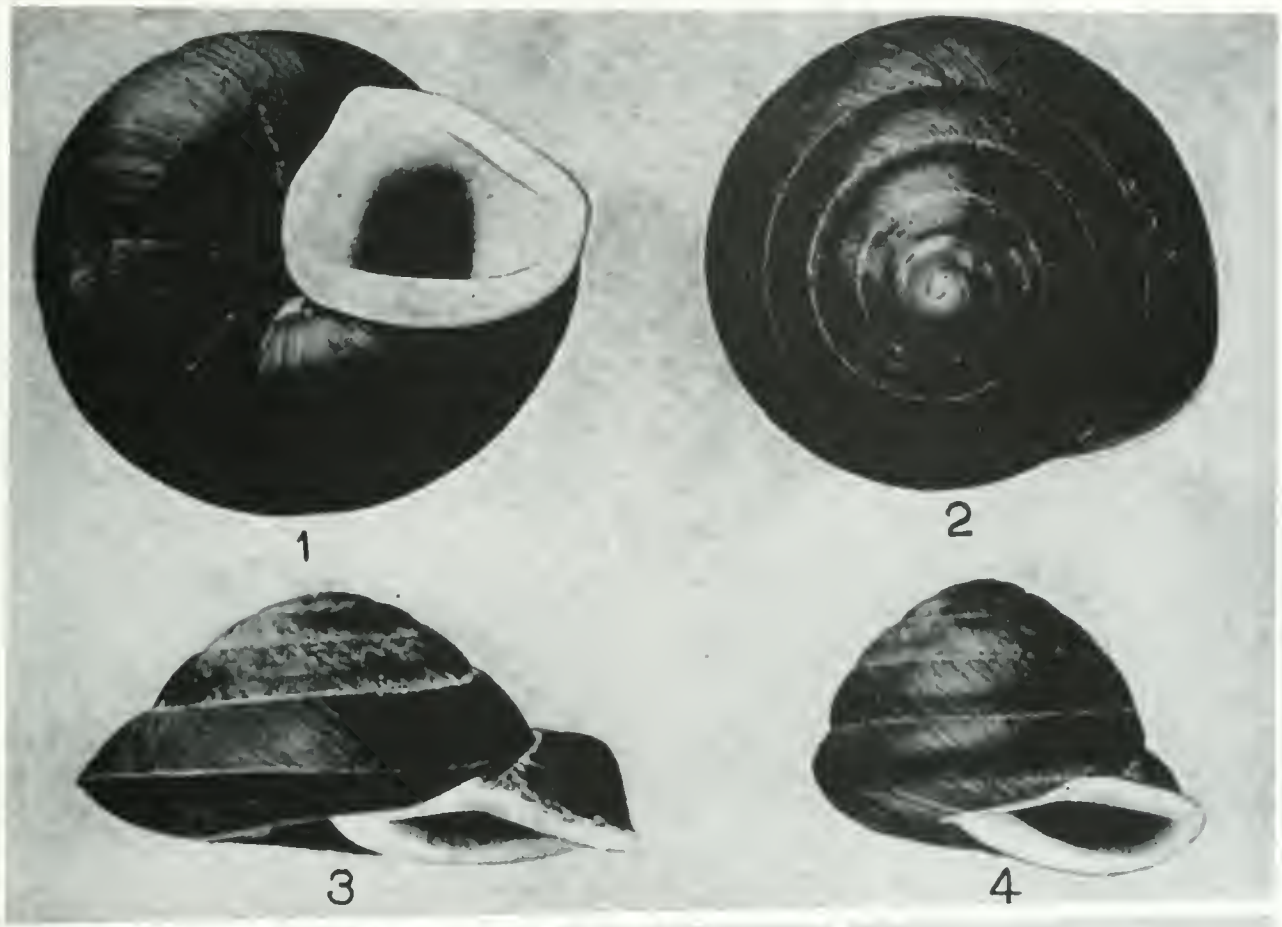
Published Information: Clench and Turner (1962) did not list *Urocoptis alleni, Cerion paucicostatum, C. alleni,* or *C. victor* among Pilsbry's taxa. All authors who have used these names have credited them to Torre (see full synonymy in Richardson, 1991:81; 1992:8, 77, 109). Aguayo and Jaume (1950) included these names in their list of Torre's taxa, but Bartsch (1950) did not include plate 4, figures 7–13 in his list of Torre's works. Because these authors did not critically evaluate the validity of Torre's authorship of these names, no inference of his authorship can be drawn from their works. Torre (1929) did publish a paper on Cuban Urocoptidae, but he did not mention *U. alleni* in it.

Catalog and Label Information: In the vial with the illustrated specimen of *U. alleni* (ANSP 146901) is a clay and cardboard mounting strip of the style used by Pilsbry, suggesting that Pilsbry prepared the specimen for illustration. As editor of the journal, however, he often would have prepared plates for other authors, so it is possible that the species was illustrated at Torre's request. The ANSP catalog entry for this lot, however, reads "*Urocoptis alleni* Torre ms," with no mention of type status. The specimens were collected by P. J. Bermudez and C. C. Allen in 1927 and donated by Bermudez on October 22, 1928. Because Torre did not collect or donate the lot from which the illustrated specimen was chosen, it seems unlikely that he was involved in preparing the plate. The original labels for *U. alleni* indicate that the specimens are "cotypus" of "*Urocoptis alleni* Torre, mss," while the original labels for *C. alleni* and *C. paucicostatum* do not indicate type or manuscript status. There is no original label for *C. victor*. Among the three *Cerion* species on the plate, Torre donated only specimens of *C. victor*; the others were collected and donated by C. Curry Allen.

ANSP Archives: The archives at ANSP contain a letter from H. A. Pilsbry to C. C. Allen dated November 2, 1928 (Archives Collection 98). In it, Pilsbry related that H. N. Lowe had said that "you [Allen] had a lot of Cuban snails that would be of interest, and he [Lowe] especially said that *Cerion alleni* ought to be figured in the Nautilus. I would very much like to have specimens of this for the collection of the Academy and to figure

→

Figures 1–13. Plate 4 from *The Nautilus*, 1929, 42(3), January, recaptioned. **1–6** from Pilsbry's (1929a) paper on Cuban *Caracolus*; **7–13** from Pilsbry (1929b). **7.** *Tetrentodon* (*Anafecoptis*) *alleni* [Pilsbry, 1929], lectotype ANSP 146901. **8–9.** *Cerion paucicostatum* [Pilsbry, 1929]. **8.** Lectotype ANSP 146965. **9.** Paralectotype ANSP 146966. **10–11.** *Cerion alleni* [Pilsbry, 1929]. **10.** Lectotype ANSP 146964. **11.** Paralectotype ANSP 400359. **12–13.** *Cerion victor* [Pilsbry, 1929]. **12.** Paralectotype ANSP 400360. **13.** Lectotype ANSP 147406.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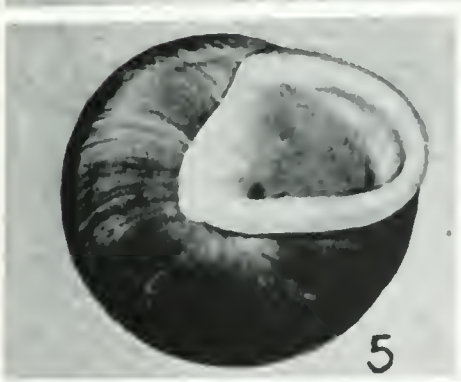
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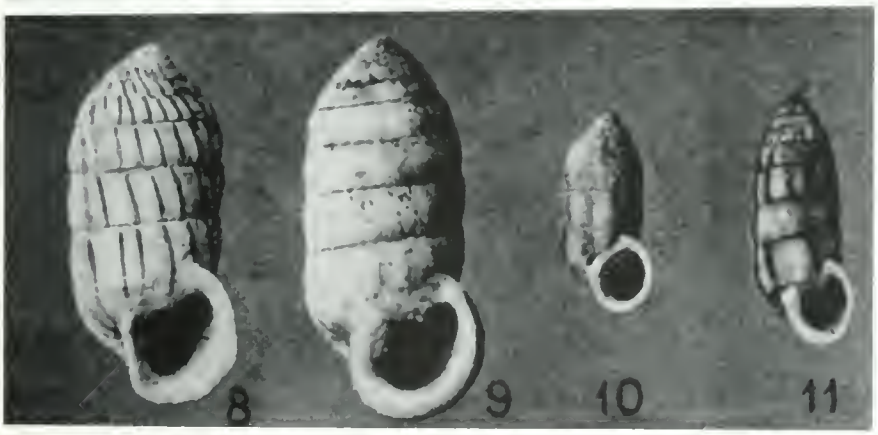
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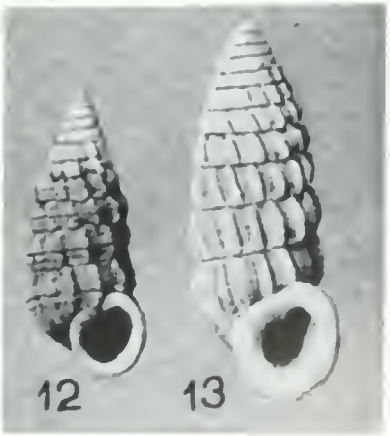
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also *Cerion paucicostatum*." These lines confirm that the specimens that became the types of these names came to Pilsbry from Allen, with Torre manuscript names applied to them, and not directly from Torre.

Also in the archives (Collection 845) is the manuscript of Torre's (1929) paper on Cuban Urocoptidae, published in the ANSP *Proceedings*. Written in Spanish, it was translated into English and heavily edited by Pilsbry, who omitted some taxa. The plates and text figures do not accompany the manuscript and were probably prepared by Pilsbry. Neither version of the manuscript mentions any of the four names in question. There is no material in the archives indicating any connection between Torre and the publication of these names in *The Nautilus*.

Conclusions About Authorship: The archival records at ANSP strongly suggest that Pilsbry is responsible for the publication of *Cerion paucicostatum* and *C. alleni*, because he requested the specimens he illustrated from C. C. Allen. Similarly, Bermudez, not Torre, donated the illustrated specimen of *Urocoptis alleni* to ANSP and there is therefore no direct connection between Torre and the publication of these three species. Torre did donate the illustrated specimen of *Cerion victor* to ANSP, but there is no evidence that he had any involvement with the description of these specimens. Pilsbry's letter to Allen suggests that he illustrated the *Cerion* species as a service to readers of *The Nautilus*; presumably he had enough room on the plate to include *C. victor*, specimens of which he had on hand. We therefore regard all four names as Torre manuscript names first made available by Pilsbry (1929b), in a previously unrecognized Pilsbry publication.

Because the publication was anonymous, Pilsbry's name should be enclosed in square brackets (ICZN Recommendation 51A) when citing the species. Torre's name need not be mentioned, as the ICZN does not make provision for citing authors of manuscript names, but its mention provides easier access to the literature relevant to each taxon. Malacologists often place authors of manuscript names in quotation marks, but this convention is also used for authors of other kinds of unavailable names. For clarity, we recommend that the reason for unavailability be specified, if for some reason it is desirable to cite such authors. For example, *Cerion alleni* [Pilsbry, 1929] (*ex* Torre MS) is preferable to *Cerion alleni* "Torre" [Pilsbry, 1929].

STATUS OF TYPE MATERIAL

Because the names in question were introduced in plate captions, without indication of type status or of the number of specimens examined, the contents of the type series must be determined from external evidence (ICZN Recommendation 72B). Lectotypes have previously been designated for all four species. All known type material for these species is housed at ANSP; other material distributed by Torre to other collectors and museums with identical manuscript names does not have type status as it was not examined by Pilsbry, nor was it split from ANSP type lots based on the data from ANSP catalog books.

Urocoptis alleni [Pilsbry, 1929]

Type locality: Peña Blanca, Sierra Anafe [near Guanajay, Pinar del Río]

Lectotype: ANSP 146901, by subsequent designation of Baker (1963:221); figure 7 in Pilsbry (1929b) and herein.

Paralectotypes: ANSP 400357, 85 specimens split from lectotype lot, which originally had "25+" specimens according to ANSP catalog. The specimens that Abbott (1989: 123) figured as "paratypes" are likely part of this lot, as we know of no other lot of this species (type or non-type) which contains this many specimens.

Comments: Several other lots previously considered part of the type series (AMNH 154587; ANSP 167470, 220390; DMNH 135379, 147064; FMNH 75298, 92027, 103816; MCZ 247785, 79469) were collected by people other than Bermudez and/or Allen and were not part of the material Pilsbry examined. The species is currently placed in the genus *Tetrentodon* Pilsbry, 1903, and is the type species of the subgenus *Anafecoptis* Jaume & Torre, 1972.

Cerion alleni [Pilsbry, 1929]

Type locality: Antilla, [Holguín Province], Oriente

Lectotype: ANSP 146964, by subsequent designation of Baker (1963:206, as ANSP 146964a); figure 10 in Pilsbry (1929b) and herein.

Paralectotypes: ANSP 400359, 3 specimens split from lectotype lot, which originally had 4 specimens; lot includes specimen in figure 11 of Pilsbry (1929b) and herein.

Comments: We have examined USNM 346663 from the Bahamas, labeled by Bartsch with this name and the status "type," and conclude that is not a type specimen, nor even this taxon, but rather a homonymous Bartsch manuscript name.

Cerion paucicostatum [Pilsbry, 1929]

Type locality: Cape Maisi, [Guantánamo Province, Oriente]

Lectotype: ANSP 146965, by subsequent designation of Baker (1963:207, as ANSP 146655a); figure 8 in Pilsbry (1929b) and herein.

Paralectotypes: ANSP 400358, 1 specimen split from lectotype lot, which originally had 2 specimens; ANSP 146966, 2 specimens, including specimen in figure 9 of Pilsbry (1929b) and herein.

Comments: Specimens from Miller Hill, southern Eleuthera Island, Bahamas labeled "paratypes" (e.g., FMNH 42323, 119727, 119777) are not part of the type series for this taxon, but are paratypes of *C. paucicostatum* Clench, 1934 (non [Pilsbry, 1929]) (= *C. indianorum* Clench, 1934; see Clench, 1957:149, 157; Richardson, 1992:51).

Cerion victor [Pilsbry, 1929]

Type locality: Caleta de Ovando, [Guantánamo Province], Oriente. [ANSP catalog adds "about 40 miles W of Punta de Maisi on the south coast."]

Lectotype: ANSP 147406, by subsequent designation of Clench and Aguayo (1952:419, by inference of holotype); figure 13 in Pilsbry (1929b) and herein.

Paralectotypes: ANSP 400360, 2 specimens; ANSP 400361, 1 specimen, figure 12 in Pilsbry (1929b) and herein; both lots split from the lectotype lot, which originally had 4 specimens.

Comments: Baker (1963:207) independently designated ANSP 147406a (Pilsbry 1929b, fig. 12) as lectotype. Clench and Aguayo's (1952) designation has priority, making Baker's invalid, and the specimen he designated is a paralectotype, now cataloged as ANSP 400361. The specimens of *C. victor* cited by Clench and Aguayo (1952), MCZ 128975 and 181758, as well as MCZ 181756, 181757, 192282, 192283 and ANSP 323229 have no original data labels and are not from the cited type locality; they are therefore not considered paralectotypes. Abbott (1989:72) figured a dozen "paratypes" of *C. victor,* but, because no recognized paralectotype lot contains this many specimens, they are also excluded from the type series and may be part of one of the above cited lots of excluded specimens.

ACKNOWLEDGMENTS

Thanks to John Slapcinsky (FMNH), Tim Pearce (DMNH), Daniel Graf (MCZ), and Robert Hershler (USNM) for providing data and loans of specimens from their respective institutions. Thanks also to Paula Mikkelsen (AMNH) for reviewing an early version of the manuscript, Alan Harvey (AMNH) for comments and suggestions, and Jerry Harasewych (USNM) for contrarian comments that spurred us to dig deeper in our research. Two anonymous reviewers offered comments that further improved the manuscript.

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Anatomy and Systematics of *Anticorbula fluviatilis* (H. Adams, 1860) (Bivalvia: Lyonsiidae) from the Amazon Basin, Brazil and Peru

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ABSTRACT

Anticorbula fluviatilis (H. Adams, 1860) is an enigmatic freshwater bivalve not closely related to the usual groups of freshwater bivalves. Due to its rarity and consequent lack of specimens, the validity of the genus and species, their occurrence in the freshwater habitat, and even their existence, have been questioned. Other species of closely similar taxa are common in estuarine areas of northern and western South America. The familial allocation of *Anticorbula* has also been problematic. Specimens of *A. fluviatilis* (with soft parts) collected in the Amazon Basin including material from the type locality were examined, and the validity of the genus and species confirmed. A detailed description of the anatomy is provided as the foundation for future systematic comparisons. Diagnostic characters include possibly vestigial lithodesma, small foot with byssus, mantle lobes almost entirely fused (with pedal and pallial apertures only), lack of siphons, very large posterior retractor muscles of foot, stomach with ducts to digestive diverticula only on right side, and style sac separated from intestine. The presence of these characters suggests allocation within the family Lyonsiidae, but this familial allocation should remain provisional until a better definition of the Lyonsiidae is made available.

Key words: Lyonsiidae, *Anticorbula fluviatilis*, Amazon basin, Brazil, Peru, systematics, morphology.

INTRODUCTION

The Amazon Basin is a region of incomparable biodiversity; despite this, its freshwater and terrestrial mollusks are very poorly known. Unusual organisms are often found, including the species re-described herein.

Himella fluviatilis, an unusual freshwater mussel collected in the Marañon River, Peru, was described by H. Adams in 1860. The genus name *Himella* was pre-occupied (Dallas, 1852, Insecta), and a new name was proposed, *Anticorbula* Dall, 1898, as subgenus of the marine genus *Corbula* Bruguière, 1797. Morrison (1943) described the genus *Guianadesma* for an estuarine species, *G. sinuosum*, from Guyana, which is very similar to *Anticorbula fluviatilis*. The genera *Anticorbula* and *Guianadesma* were considered synonyms of *Ostomya* Conrad, 1874 by at least Keen (1969), and Vaught (1989). However, Nuttall (1990) pointed out that *Ostomya* was a distinct taxon and considered *Guianadesma* as valid, an opinion later shared by Leistikow and Janssen (1997). Nuttall (1990) also suggested the possible synonymy between *Guianadesma* and *Anticorbula*. This latter author considered it as *nomen dubium* based on lack of data on types and substantiated locality data (p. 319). On the other hand, Nuttall did not explore further the differences or similarities between these two taxa.

Although the Marañon River, type locality of *A. fluviatilis*, is very distant and far removed inland from the eastern Amazon coastline, most reported occurrences situate this and related species on estuarine and coastal areas (Altena, 1969, 1971; Morrison, 1993; Nuttall, 1990). These reports naturally bring into question whether these organisms actually occur in true freshwater habitats. On the other hand, Adams did not show any doubts about the provenance of *A. fluviatilis*, and Pilsbry (1944) examined additional material from eastern Peru: Essequibo and Cyuni rivers, and even from Marañon River itself. He also figured some specimens of *A. fluviatilis* for the first time. Also addressing this question, Leistikow and Janssen (1997) published their finding of specimens identified as *Guianadesma sinuosum* from Manaus, Brazil, a site located midstream on the Amazon Basin.

The family allocation of the above mentioned genera has also been inconsistent; some authors allocate them to Lyonsiidae (Pandoroidea) (Keen, 1969; Altena, 1971), other authors to Corbulidae (Myoidea) (Pilsbry, 1944; Nuttall, 1990; Leistikow & Janssen, 1997).

Except for the schematic figure and a brief description of the soft parts of *G. sinuosa* (Morrison, 1943), no other anatomical data on South American freshwater and estuarine lyonsiids has been published. The above mentioned references dealt only with conchological and environmental data.

The type specimens of *A. fluviatilis* have not been located (Altena, 1971:82; Nuttall, 1990:290; F. Naggs, pers. comm.), which precludes the resolution of the systematic problems.

A lot with preserved specimens was collected by a team of ichthyologists from the Museu de Zoologia in the Trombetas River, Pará, Brazil (Amazon Basin), a freshwater locality well removed from the coast. The identification of these specimens as *A. fluviatilis* was attained upon examination of the literature and comparison with material from the type locality. The present detailed study of their morphology should help clarify the above mentioned conceptual problems and establish the identity of the species. It should also provide the foundation for further comparative studies of specimens from other (mainly estuarine) areas.

MATERIAL AND METHODS

The specimens were initially preserved in 4% formalin and transferred to 70% ethanol. The dissection was conducted under a stereomicroscope, with the specimens immersed in water. Serial sections were made using standard histological techniques and stained with Mallory. All drawings were made with the aid of a *camera lucida*. The intestinal loops and other visceral structures were examined through dissections and serial sections. The SEM figures were obtained at the "Laboratório de Microscopia Eletrônica do Instituto de Biociências da USP".

The specimen preservation was not good enough to allow for a detailed examination of cilia; these are not shown in detail in the serial section figures (Figures 20–22).

The following abbreviations are used in the figure captions: aa, anterior adductor muscle; an, anus; au, auricle; by, byssus; dd, ducts to digestive diverticula; dh, dorsal hood; es, esophagus; ex, excurrent aperture; fa, foot aperture; ft, foot; ia, intestinal aperture; id, inner demibranch; in, intestine; is, incurrent aperture; lg, ligament; li, lithodesma-like projection of mantle; ll, left mantle lobe; mb, mantle border; mo, mouth; mu, mantle ventral union; od, outer demibranch; pa, posterior adductor muscle; pe, periostracum; pl, pallial line; pp, palps; pr, posterior protractor muscle of foot; ps, pallial sinus; ra, anterior retractor muscle of foot; ri, hinge; rp, posterior retractor muscle of foot; rt, rectum; rv, right valve; sa, sorting area; sp, style sac aperture; ss, style sac; st, stomach; sy, crystalline style; te, testis; um, umbo; ve, ventricle; vg, visceral ganglia; vm, visceral mass.

The following institutional abbreviations are used in the text: ANSP, Academy of Natural Sciences of Philadelphia, Philadelphia; BMSM, The Bailey-Matthews Shell Museum, Sanibel, Florida; MZSP, Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil.

SYSTEMATIC DESCRIPTIONS

Genus *Anticorbula* Dall, 1898

Himella H. Adams, 1860:203 (non Dallas, 1852); type species (by monotypy): *H. fluviatilis* H. Adams, 1860; pre-occupied name (Nuttall, 1990:319).

Corbula (*Anticorbula*) Dall, 1898:839, *nomen novum*.

Aloidis (*Anticorbula*).—Morretes, 1949:47 (in part).

Anticorbula.—Keen, 1969:847; Vaught, 1989:140 (in both references as synonym of *Ostomya* Conrad, 1874).

Remarks: *Anticorbula* is the oldest valid name and should be used for this species. The similarity between the type species of the monotypic genera *Anticorbula* and *Guianadesma* is clear; thus these 2 genus names may be synonyms. However, the synonymy will be resolved only after a detailed anatomical analysis of *G. sinuosum* (type of *Guianadesma*).

Anticorbula fluviatilis (H. Adams, 1860) (Figures 1–22)

Himella fluviatilis H. Adams, 1860:203 [Marañon River, Peru].

Corbula (*Anticorbula*) *fluviatilis*.—Dall, 1898:839.

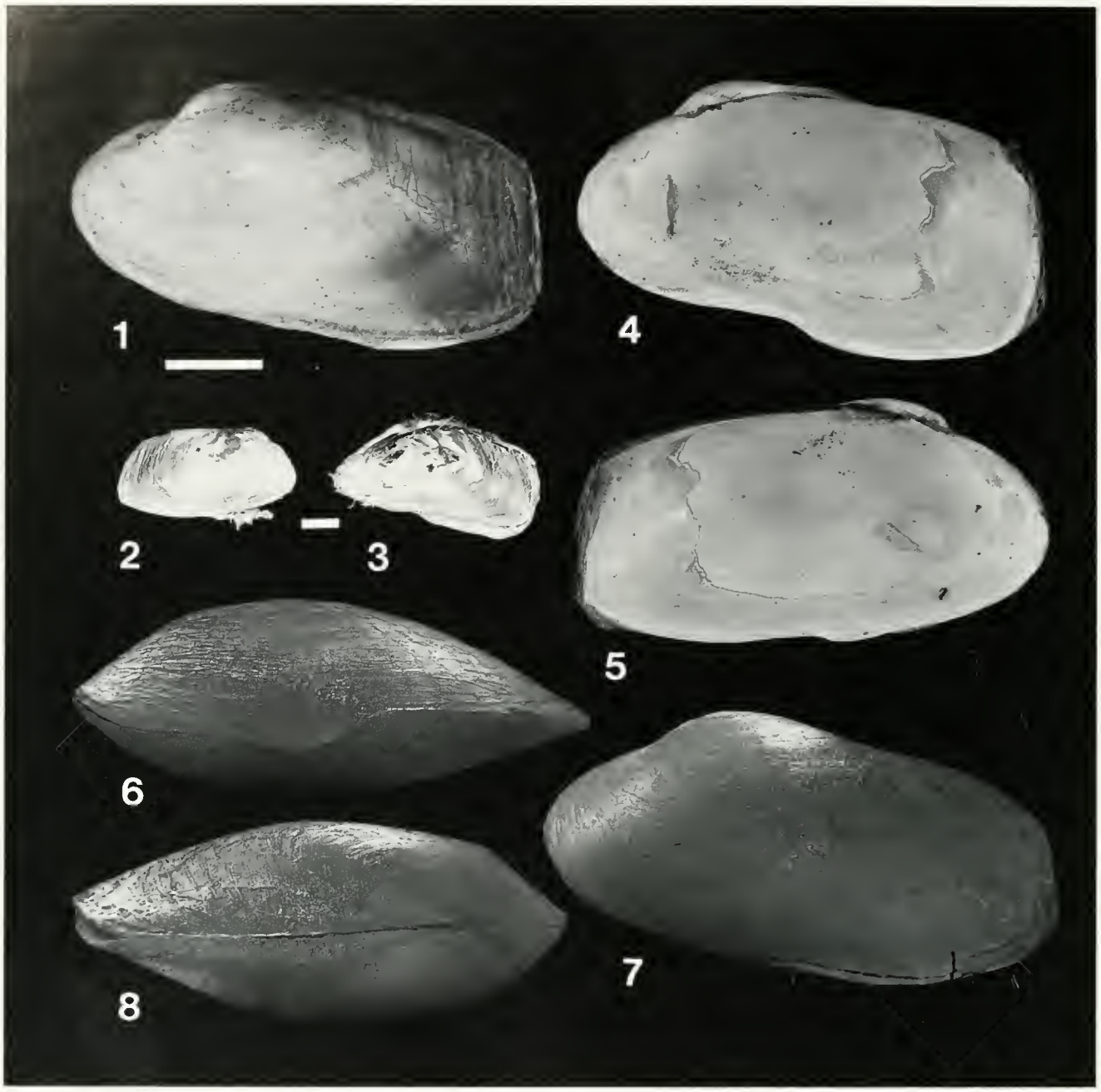
Ostomya fluviatilis.—Pilsbry, 1944:148 (fig. 1 + pl. 11, figs. 42–44)

Aloidis (*Anticorbula*) *fluviatilis*.—Morretes, 1949:47.

Anticorbula fluviatilis.—Altena, 1971:82.

Guianadesma sinuosum.—Leistikow and Janssen, 1997:17–20 (figs. 1–3) (*non* Morrison, 1943).

Description: *Shell (Figures 1–9, 19):* Of medium size (up to 25 mm), somewhat elliptical, inequivalve, irregular (Figures 2, 3), ventral edge sigmoid (Figures 6, 19). Umbones inlaid, located on anterior third of hinge, generally eroded. Periostracum semi-transparent, brown, covering ligament (Figure 19). Color light beige, with brown areas on posterior slope (Figure 1). Anterior region rounded, posterior region somewhat straight, oblique. Sculpture lacking except for concentric growth lines and undulations. Hinge edentulous, with a broad tooth in each valve posterior to umbones, each one bearing a longitudinal furrow containing most of ligament (Figures 4, 5, 9, 19). These broad teeth asymmetrical (Figure 19). Left valve tooth somewhat parallel to valve margin and close to median line; right valve tooth oblique, with posterior region relatively distant from median line and separated from the valve border by a smooth area, which gradually approaches from median line to become similar to its analogue. Ligament partly exposed, anterior extremity only a narrow thread. Posteriorly to umbo ligament gradually becomes thick and broad at about ⅓ of its length. Posterior half of this broad region hollow, opened posteriorly, filled by a conic, sharp projection of mantle (Figure 10), which suddenly becomes a narrow thread in its posterior half. Inner surface of each valve smooth, not nacreous (Figures 4, 5). Two anterior scars (Figures 4, 5, 9), a small, circular, dorsal of anterior foot retractor muscle, and other large, reniform, ventral to anterior adductor muscle. Pallial line simple, with a broader anterior region; a shallow sinus is present between this broad region and adductor muscle scar (Figure 9). A large and somewhat triangular posterior scar composed by two roughly equal (in cross-section) muscles, one dorsal to posterior foot retractor muscle, other ventral to posterior adductor muscle. Ven

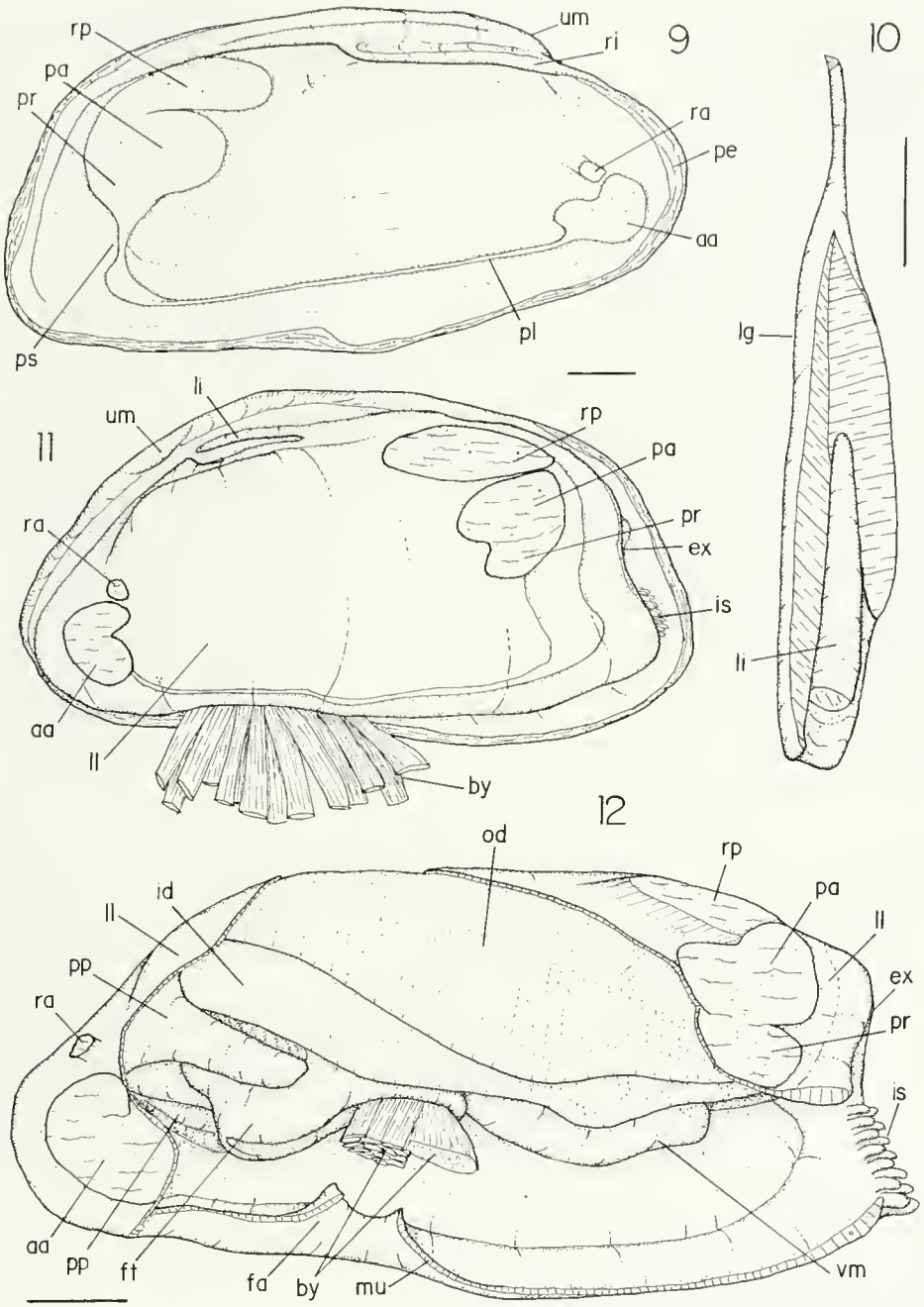


Figures 1–8. Shell of *Anticorbula fluviatilis*. **1.** Left valve showing most frequent color pattern; **2, 3.** Two specimens showing variation in outline; **4.** Right valve, inner view; **5.** Left valve, inner view; **6–8.** SEM micrographs of 1 specimen. **6.** Ventral view; **7.** Left view; **8.** Dorsal view. Scale lines = 2 mm.

tral region of protractor muscle of foot small, triangular. Further details on shell morphology were given by Leistikow and Janssen (1997:17–18, figs. 1–2).

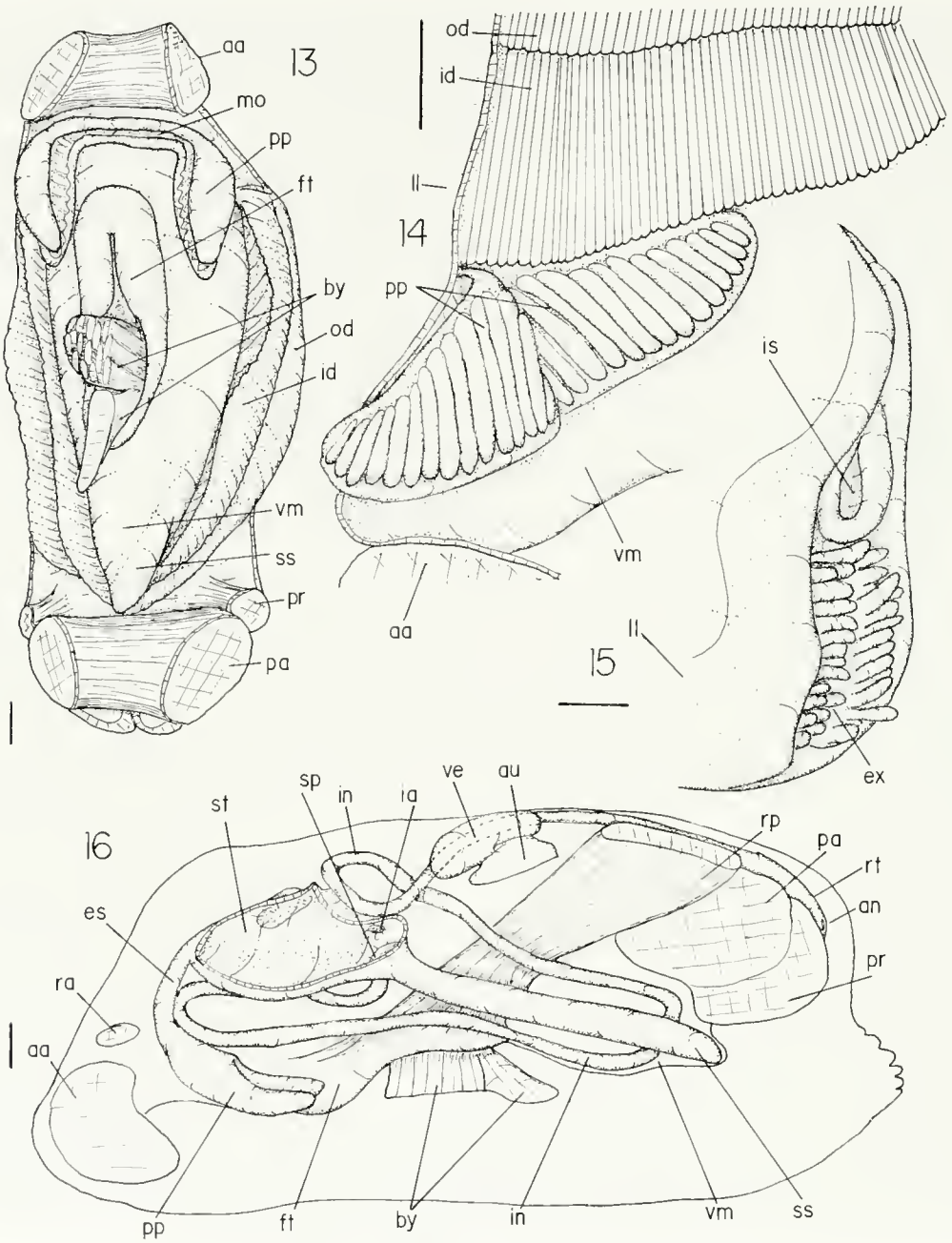
Mantle: Pale cream in color, in some specimens with dark brown spots in umbonal region. Mantle lobe borders almost entire fused (Figures 11, 12, 20), a narrow, funnel-like, conic pedal aperture (Figure 12). Incurrent aperture surrounded by two rows of stubby papillae (Figures 12, 15); each papilla white in color, dark brown minute spots on base, rounded tip. Excurrent aperture narrow, edged by thick borders without papillae (Figure 15). Lobes union evolves inner folds (Figure 20).

Foot and muscles: Foot small, sessile in antero-ventral half of visceral mass (Figures 12, 13). Byssal furrow occupying most of foot ventral region; anterior half a narrow, deep furrow (Figure 13); posterior half broad, opened, bearing two large byssal bundles (Figures 12, 13, 15). Anterior byssal bundle composed by several ribbon-



Figures 9–12. Anatomy of *Anticorbula fluviatilis*. **9.** Shell, left valve, inner view, showing muscle scars and hinge; **10.** Ligament extracted, left view, a quarter was artificially cut to show inner mantle projection, possibly a vestige of lithodesma; **11.** Hole specimen, left view with left valve extracted, outer surface of mantle exposed; **12.** Mantle cavity, left view, infra-branchial portion of mantle extracted by an incision surrounding insertion of ctenidium, visceral mass, adductor muscles and in middle region of ventral mantle fusion. Scale lines = 1 mm.

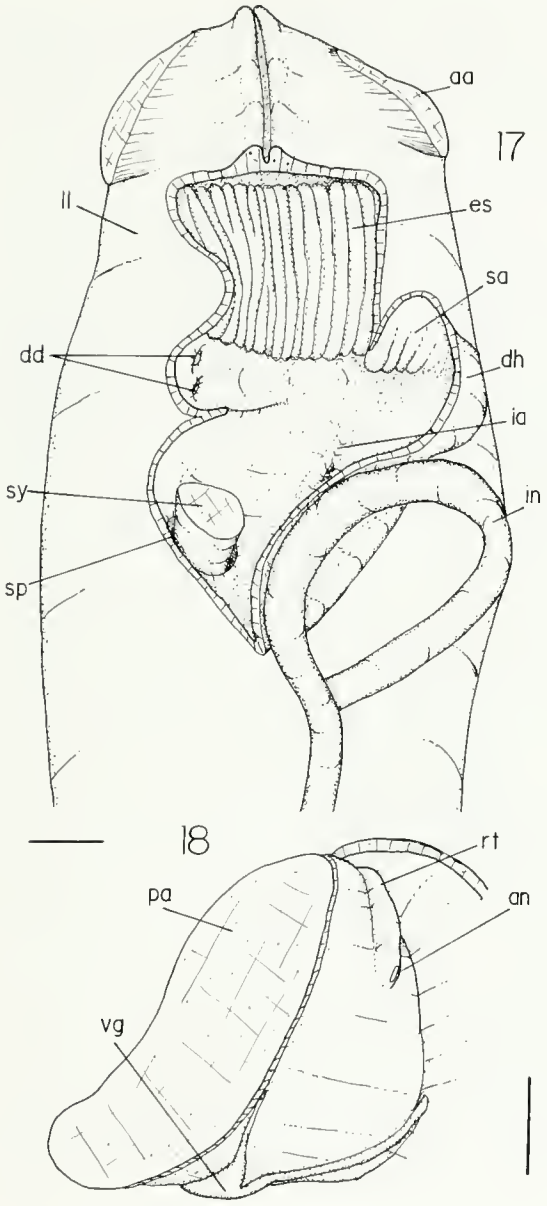
like, flattened fibers; posterior bundle broad and massive. Anterior and posterior adductor muscles somewhat equal in size (Figure 11). Anterior adductor muscle located very anteriorly and ventrally. A pair of large visceral ganglia attached to its ventral surface of posterior adductor muscle (Figure 18). Pair of anterior foot retractor muscles small, slender, inserted in anterior region of foot. Pair of posterior foot retractor muscles large (Figure 16), flattened at origin (longer antero-posteriorly), just dorsal and anterior to posterior adductor muscle, each situated very close to other member of pair, separated only by a narrow space where rectum runs. Posterior retractors gradually become narrow and cylindrical, inserted in foot muscles just dorsally to byssal gland.



Figures 13–16. Anatomy of *Anticorbula fluviatilis*. **13.** Mantle cavity, ventral view, ctenidium part deflected, mantle extracted; 14. Detail of region of left palp and adjacent structures, left view, outer hemipalp deflected to show its inner folds; **15.** Detail of incurrent and excurrent apertures (incurrent inferior), left, slight posterior view; **16.** Digestive tubes and part of muscular and circulatory systems seen as the animal was transparent, left view, left wall of stomach extracted. Scale lines = 0.5 mm.

Mantle cavity organs Inner surface of mantle smooth, without additional structures (Figure 11), mantle edge thick. Ctenidium long, about ⅔ of length of mantle cavity and about half of dorso-ventral distance (Figures 12, 13); filaments very narrow, producing a uniform surface. Outer demibranch not covering inner demibranch. Outer demibranch divided into two regions (Figure 12): dorsal ⅓ with oblique filaments, ventral ⅔ with filaments that become perpendicular to free edge of ctenidium. Anterior edge of outer demibranch fused with mantle. Inner demibranch simple, occupying little more than half of volume of outer demibranch, only perpendicular filaments present. Anterior edge fused with mantle and antero-ventral angle partially covered by palps. Food grooves present on free edges of both demibranchs (Figure 20). Profile of ctenidium filaments is shown in Figure 22.

Digestive system: Palps somewhat small, antero-pos-



Figures 17–18. Anatomy of *Anticorbula fluviatilis*. **17.** Stomach and adjacent region, dorsal view, anterior part of gastric dorsal wall extracted, posterior part deflected to right jointed with the intestine loop which crosses this area; **18.** Detail of posterior adductor muscle, left, slight posterior view, left lobe of mantle extracted to show anus and visceral ganglia. Scales = 0.5 mm.

teriorly elongated, free extremity tapering off to a rounded tip (figures 12–14). Outer surface of palps smooth. Inner surface of palps with several broad, oblique folds; profile of folds shown in Figure 21. Each fold with rounded extremities, ending at some distance from palp edge, with smooth inner margin (Figure 14). Inner folds evanesce near mouth (Figure 13). Mouth large, with smooth inner surface. Esophagus wide, short, flattened dorso-ventrally, curved, not attached to, separated from adductor muscle (Figure 16), inner surface with several, uniform, longitudinal, low folds (Figure 17). Stomach (Figures 16, 17) spacious, located just posterior to shell umbones. Esophageal folds end suddenly at same height along esophagus. Two small orifices of digestive diverticula present on left anterior region of stomach. Right anterior region characterized by valve-like, small septum that represent anterior limit of a dorsal hood. Dorsal hood short, broad, with rounded distal extremity, internally with several low, longitudinal folds. A constriction present in stomach region opposite to dorsal hood. Posterior region of stomach with two orifices (Figures 16, 17): aperture of style sac, larger, on left side; intestine origin, smaller, on right side. Style sac long, straight, separated from intestine (Figures 16, 20); posterior extremity rounded, bulging in posterior-ventral extremity of visceral mass (Figures 13, 16). Intestine (Figures 16, 17) narrow, without inner folds; intestine runs anteriorly, surrounding right ventral surface of stomach. After forming a loop near esophagus intestine is directed posteriorly, brodering dorsal surface of foot; near right posterior region of style sac intestine is directed antero-dorsally to postero-dorsal region of stomach; in this region, a loop touches dorsal gastric wall on style sac and intestine apertures. This loop runs dorsally through ventricle, between posterior foot retractor muscle and postero-dorsal surface of posterior adductor muscle. Anus represented by a small orifice without papilla or glands (Figures 16, 18).

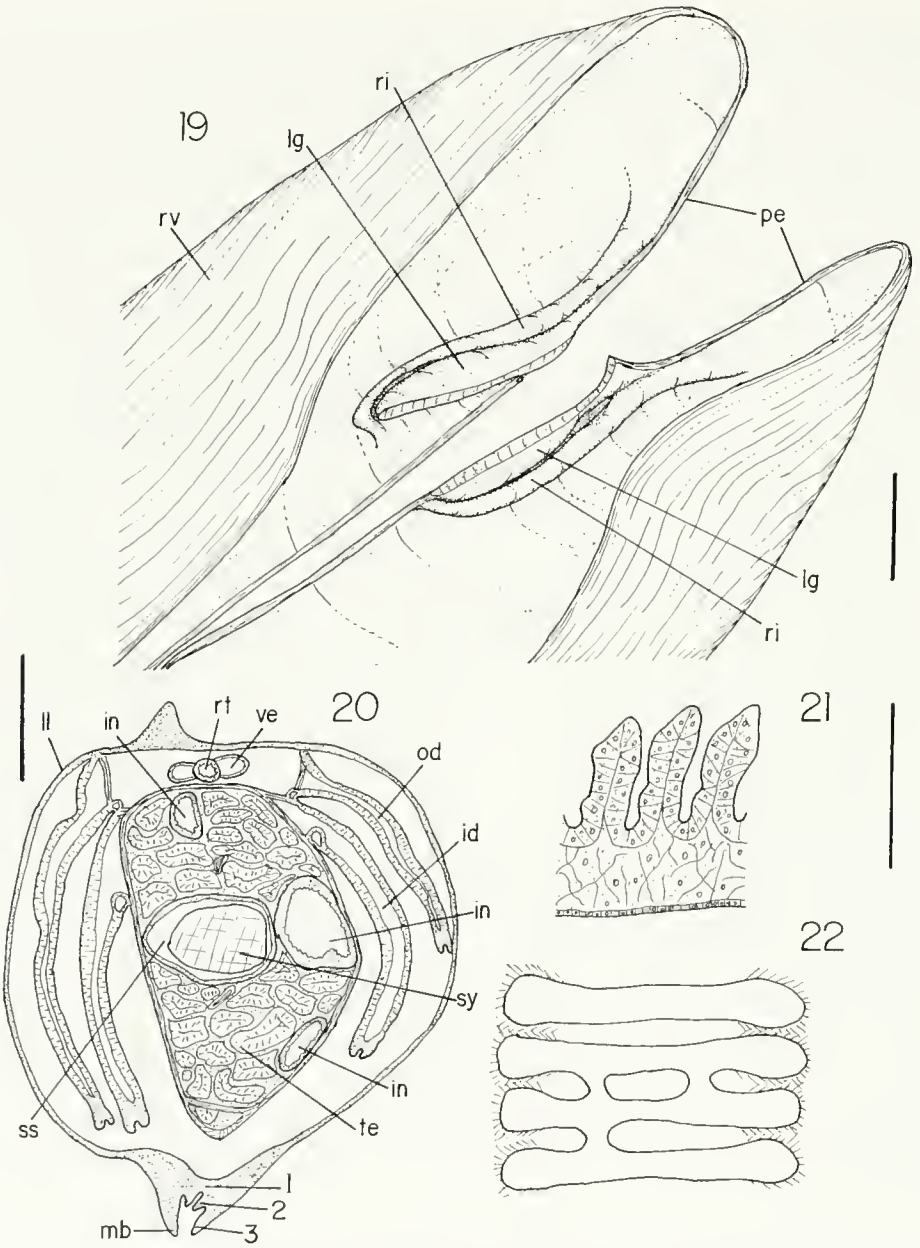
Visceral sac: Digestive diverticula almost completely restricted to space around stomach, in mid-dorsal region of animal. Remainder of visceral sac filled by gonochoristic gonad (Figure 20), which surrounds digestive tubes, and is separated into several elongate, somewhat large acina. Transversal muscles very small, present mainly in ventral, peri-pedal regions.

Habitat: Found in river with mild current, about 5 m in depth, attached by byssus into furrows of dead tree bark.

Material examined: BRAZIL: MZSP 28788, 3 specimens, Pará; Trombetas River, 1°41′51″S 55°51′8″W, Lundberg et al. col., 24 Oct. 1994; MZSP 28787, 5 specimens, Xingu River, Porto de Moz, 5 specimens, 9 Aug. 1968; MZSP 28789, 250 shells, and BMSM 1007, 3 shells, Alenquer River, Ponta de Pedregulho, Lago Grande, 21 Sep. 1969, col. EPA no. 690073–4; PERU: ANSP 125525, 2 shells, Marañon River, Charles M. Wheatley Collection, (material examined by Pilsbry, 1944).

DISCUSSION

The problematic allocation of the genus *Anticorbula* at the family level is mostly due to the poor systematic definitions of the relevant bivalve families; apparently there is no sound information (good diagnoses based on synapomorphies) on each of the following families that



Figures 19–22. Shell and serial sections of *Anticorbula fluviatilis*. **19.** Shell, detail of anterior half, ventral view, valves partially opened to show hinge region. Scale line = 2 mm; **20.** Transversal (frontal) section in approximately middle region of animal. Scale line = 1 mm; **21.** detail of middle region of outer hemipalp, inner folds cut transversally; **22.** Transversal section of ctenidium filaments at midline, outer demibranch. Scale lines (21–22) = 0.1 mm. Histological sections (20–22): Mallory stain, 5 μm.

would allow for the clear cut, indisputable allocation of *Anticorbula* to any of them. As commented in the introduction, various authors have allocated this genus in the families Corbulidae (Myoidea) and Lyonsiidae (Pandoroidea), as well as some affinity with the Myidae (Myoidea), Hiatelloidea and Thraciidae (Pandoroidea) can also be demonstrated.

The familial allocation of *Anticorbula* to is not only a problem of nomenclatural nature. Not belonging to the most common freshwater groups such as Unionoida, Dreissenoidea and Corbiculoidea, *Anticorbula* seems to represent an independent invasion of the freshwater environment.

In present study, *Anticorbula* is provisionally allocated in the family Lyonsiidae. Such allocation is based on conchological characters (outline, thick periostracum covering inclusive the hinge, almost edentulous hinge, a projection of the mantle within ligament which can be a vestige of the lithodesma). On the other hand, anatomical studies on lyonsiids (Yonge, 1952; Thomas, 1993) have described animals with two ducts to the digestive diverticula, fusion of the style sac with the intestine, and

a small pair of posterior foot retractor muscles, all characters that differ from those in *Anticorbula*.

Anticorbula is similar to members of Corbieulidae (Yonge, 1947) in having poor developed siphons and only one duct to digestive diverticula. However, *Anticorbula* differs in hinge characters, in having a reduced foot with byssus, the presence of posterior foot retractor muscles and a style sac separated from intestine.

Similarities with members of Thraciidae are overall shell shape, presence of a lithodesma in ligament and fusion of mantle edge (Morton, 1995). However, *Anticorbula* differs mainly in lacking developed siphons, in having only one duct to digestive diverticula, a separation between style sac and intestine and by the byssus.

Anticorbula is similar to members of Myidae in having fusion of mantle edge and, at least of *Cryptomya californica* (Conrad) (cf. Yonge, 1951) in having not so developed siphons and separation of style sac from intestine. It differs mainly in having a byssus, the reduction of the foot and the absence of hinge teeth.

Based on data from the (Yonge, 1971), *Anticorbula* is similar to members of Hiatellidae in shell shape, in having thick periostracum, reduction of hinge teeth and of foot. In contrast, *Anticorbula* lacks siphons, has only one duct to digestive diverticula and separated style sac and intestine.

The present lyonsiid attribution to *Anticorbula* is, then, provisional. All of the above mentioned families have estuarine representatives and could perfectly include *Anticorbula* and its related genera *Guianadesma* and *Ostomya*.

The shell of *A. fluviatilis* is very similar to that of *Guianadesma sinuosum* (Morrison, 1943; Nuttall, 1990). The morphology of the soft parts of *G. sinuosum* is very superficially known (Morrison, 1943:50–51, fig. 1), and is also similar to inner morphology of *A. fluviatilis*. Both species were not synonymyzed herein mainly due their different habitats (*A. fluviatilis*, true freshwater; *G. sinuosum*, low salinity, estuarine), and also due to the lack of a detailed anatomical study of this latter species.

ACKNOWLEDGMENTS

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Egg Capsules in the Genus *Adelomelon* (Caenogastropoda: Volutidae) from the Atlantic Coast of South America

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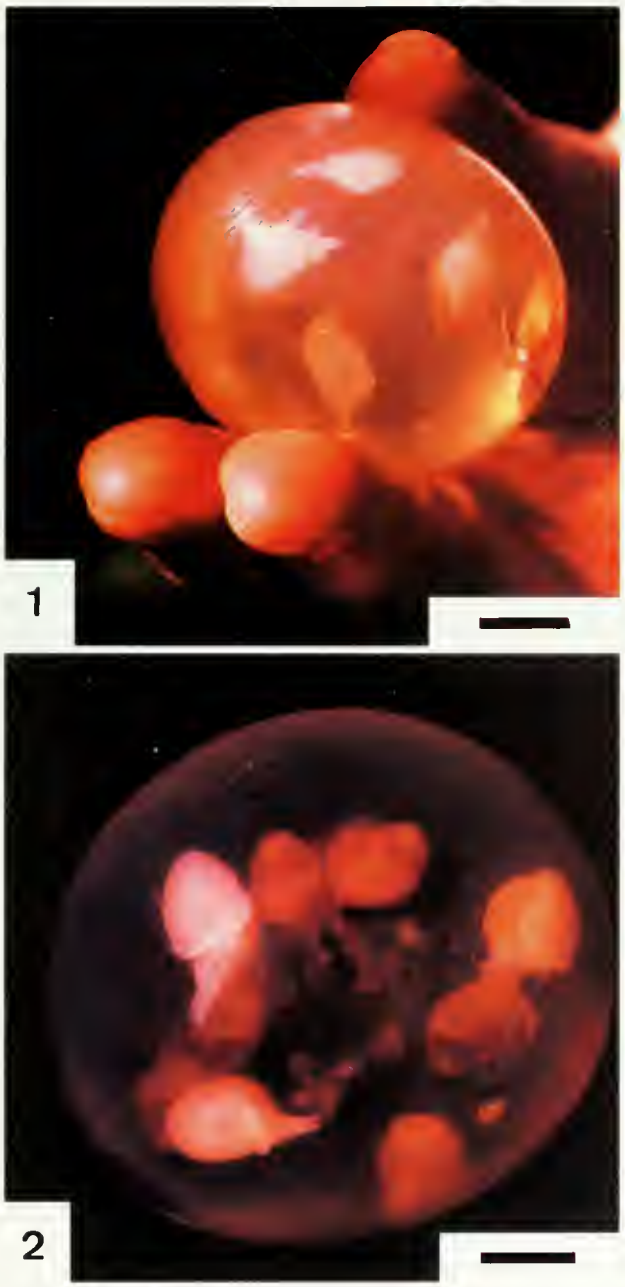
ABSTRACT

In the past century, few additions have been made to the early descriptions of egg capsules of South American volutes, and unfortunately many of these early descriptions have proven to be incorrect. Herein, we describe the egg capsule of the largest South American volute, *Adelomelon beckii* (Broderip, 1836), and redescribe the egg capsule of *A. ancilla* (Lightfoot, 1786), two species that undergo direct development. *Adelomelon beckii* produces single, conspicuous, large, globose, and hemispheric egg capsules that measure about 50 mm in basal diameter and 35 mm in height; egg capsules of *A. beckii* are found attached to scallop shells. The base of the egg capsule is round with a narrow (3 mm) margin. The number of embryos per egg capsule is 7–9. The internal volume of the egg capsule is 30–35 ml. All studied material was at pre-hatching or hatching stages and no nurse eggs were present. Crawl-away juveniles have shells measuring between 16.0–18.6 mm length. The egg capsule of *A. ancilla* is oval and flat, with a diameter of 27–46 mm. Egg capsules are never covered by a calcareous layer. They are generally attached to scallop shells. The number of embryos per capsule is 2–8 and no nurse eggs are present. The eggs are about 65 µm in diameter, the smallest among South American volutids, and are surrounded by a very dense fluid. The internal volume of egg capsules is 2.5–4.0 ml. Hatchlings are released as crawling juveniles with shells measuring 11.7–12.7 mm. Abridged information on spawn patterns in members of the Volutidae from the southwest Atlantic, Caribbean, Subantarctic, Antarctic, eastern Atlantic, Indo-Pacific, and Australia is provided.

Keywords: Caenogastropods, Volutidae, egg capsules, development, reproduction, geographic homogeneity, southern Atlantic.

INTRODUCTION

The egg capsules of relatively few South American volutids have been described. Egg capsules of *Adelomelon brasiliana* (Lamarck, 1811) were first described by d'Orbigny (1846) and have been studied by De Mahieu et al (1974) and Penchaszadeh and De Mahieu (1976). It is the largest known unattached gastropod egg capsule, with an internal volume of up to 140 ml (Figures 1–2). Other species of South American volutes for which egg capsules have been described are *Zidona dufresnei* (Donovan, 1823), *Odontocymbiola magellanica* (Gmelin, 1791) (see Penchaszadeh and De Mahieu, 1976), *Voluta musica* Linnaeus, 1758 (see Clench and Turner, 1970), and *Voluta virescens* Lightfoot, 1786 (see Bandel, 1976). Herein we describe the egg capsules of *Adelomelon beckii* (Broderip, 1836) and redescribe the egg capsules of *Adelomelon ancilla* (Lighfoot, 1786), which have been



Figures 1–2. *Adelomelon brasiliana* (Lamarck, 1811) from Mar del Plata, Argentina. Egg capsules at pre-hatching stage with live embryos. Scale bar = 10 mm.

confused several times in the literature, mostly with those of *Odontocymbiola magellanica*.

A reevaluation of volutid egg capsule descriptions for southwestern Atlantic volutids confirms that some early observations (e.g., Duhaut-Cilly in Lesson, 1840; Strebel, 1906) are incorrect (Carcelles, 1944; Penchaszadeh and De Mahieu, 1976). Therefore, this study aims to properly describe the up to now erroneously identified egg capsules of *A. ancilla* as well as to provide new information regarding the egg capsules, development, and hatching mode of *A. ancilla* and *A. beckii*.

MATERIAL AND METHODS

Egg capsules, hatchlings, and adult specimens of *A. ancilla* were collected by otter trawl. This type of gear is regularly used in the fisheries of the scallop *Zygochlamys patagonica* (King and Broderip, 1832) (for details on collecting methods see Lasta and Iribarne, 1997). Egg capsules were invariably attached to empty scallop shells.

Egg capsules and snails were fixed in 7% formalin buffered in seawater, and preserved in 70 % ethanol, and examined under microscope.

RESULTS

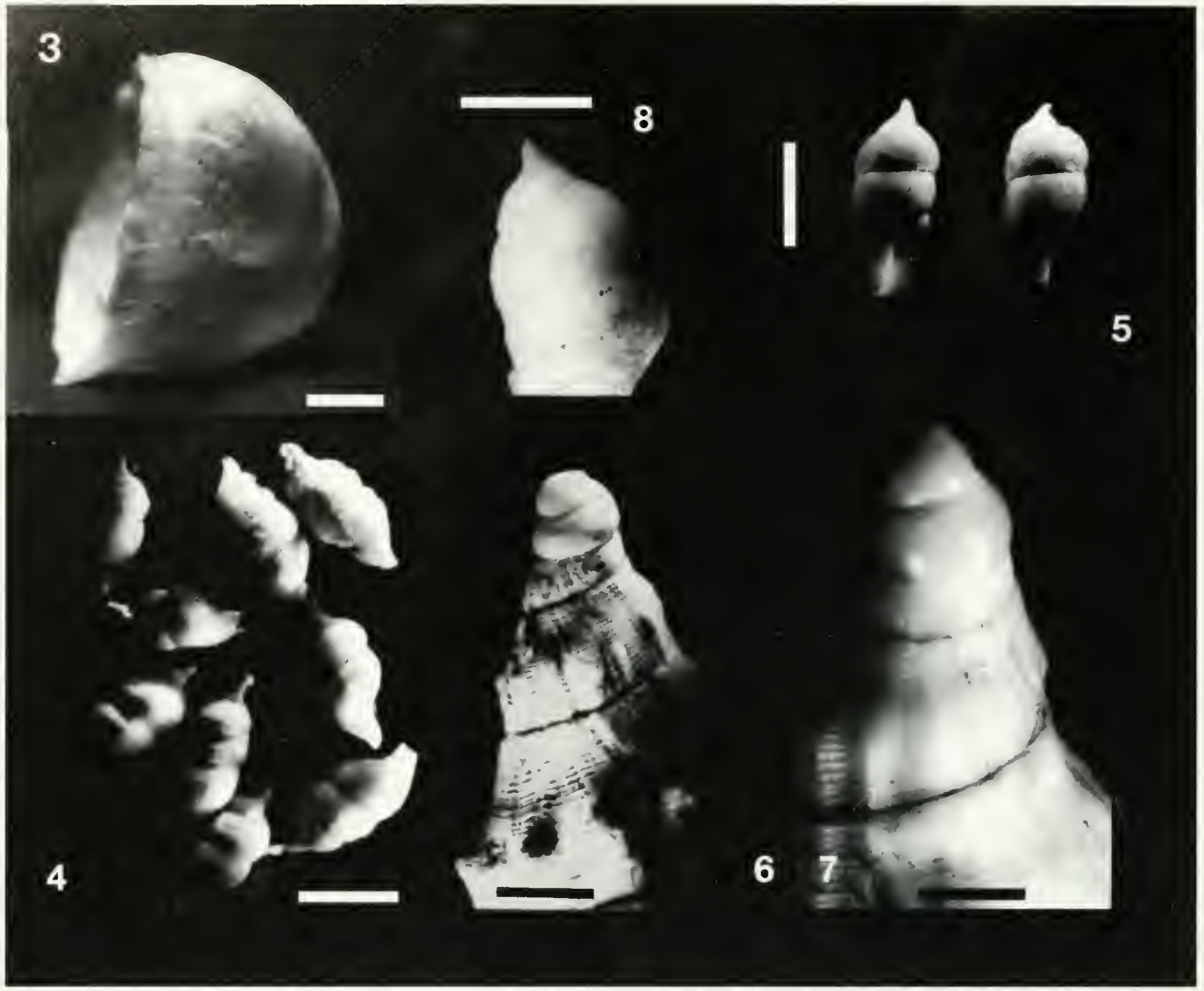
Adelomelon beckii
(Figures 3–11, Table 1)

Description of egg capsule: The spawn consists of a single egg capsule attached to hard substrate, usually the external surface of an empty scallop shell. The large egg capsule is globose and hemispherical. It measures about 50 mm basal diameter and 35 mm height. The base is round, with a narrow margin (3 mm). No external calcareous layer is present. All embryos were at late developing stages. Egg capsules contain some albuminous material and calcium carbonate particles suspended within the intracapsular liquid. The number of embryos per capsule is 7–9. Nine embryos at early shell calcification stage from a single egg capsule measure 13.5–18.5 mm in shell length. Shell size at hatching was 16.0–18.6 mm in length. The internal volume of the egg capsule is 30–35 ml, and the total volume of the pre-hatching embryos 3.7 ml (n= 9). No nurse eggs were observed. No exit plug or escape aperture is present in the capsule. Hatching snails crawl away from the egg capsule as juvenile snails. Smooth surface, three whorls, and a lanceolate calcarella characterize the juvenile shell at hatching (Table 1).

Material examined: MACN 33884, 4 egg capsules and 3 live-collected adults, off Cabo Frio, Rio de Janeiro State, Brazil, 60–80 m, trawler, Feb. 1996; MACN 12900, protoconchs of juvenile and adult shells.

Adelomelon ancilla
(Figures 12–21, Table 1).

Description of egg capsule: The egg capsule of *A. ancilla* is oval and flat, with a basal minor axis measuring 25–44 mm and basal major axis measuring 27–46 mm. The egg capsule wall lacks a calcareous layer. The number of eggs per capsule is 2–8. Nurse eggs are absent. Eggs measure 60–71 µm diameter and are embedded in a very dense intracapsular liquid containing granulated particles. This gives an opaque appearance to the capsule. The intracapsular liquid loses its opacity during embryonic development and growth. Egg capsule volume



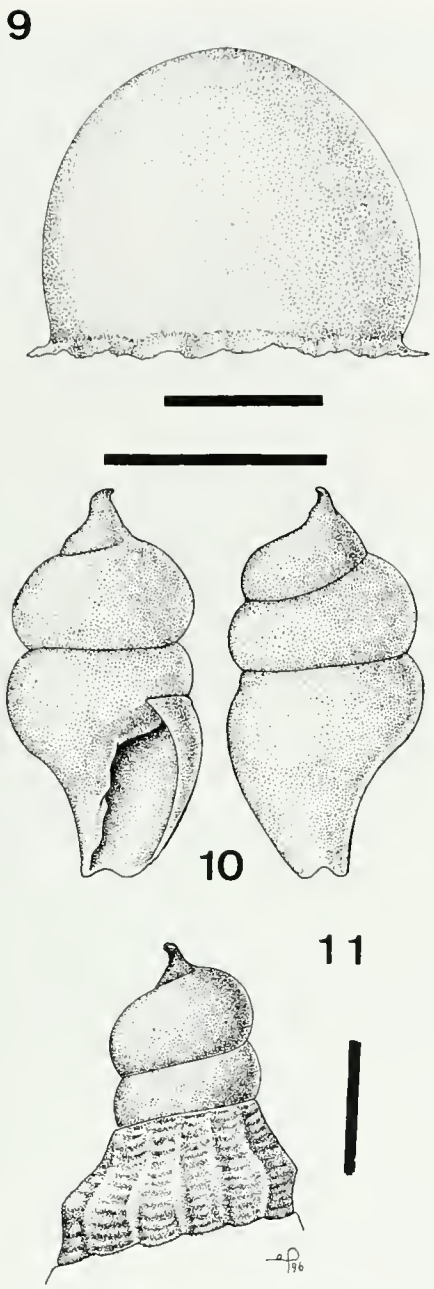
Figures 3–8. *Adelomelon beckii* (Broderip, 1836) from off Cabo Frio, Brazil. **3.** Lateral view of an egg capsule. **4.** Embryos from a single egg capsule at a late stage of development. **5.** Pre-hatching embryos. Scale bar = 10 mm. **6.** Protoconch of an adult shell from Mar del Plata, Argentina, MACN 12900. **7.** Protoconch of an adult shell from Mar del Plata, Argentina (H. Caldini Collection, Buenos Aires, Argentina). Scale bar = 6 mm. **8.** Protoconch of a young specimen from off Cabo Frio, Brazil. Scale bar = 6 mm.

is 2.5–4.0 ml. The total volume of the hatching juveniles was as much as 1.1 ml measured for 8 embryos. Hatching takes place when juveniles crawl away from the egg capsule. Juvenile shells at hatching measure 11.7–12.7 mm length, have a well-defined calcarella, and 2.5 whorls (Table 1).

Material examined: MACN 33882, 162 egg capsules, and MACN 33883, 68 hatchlings, 180 miles off mouth of Rio de la Plata, Buenos Aires Province, Argentina, trawler *Erin,* 90–105 m, Sep.–Nov. 1995, otter trawl, egg capsules invariably attached to empty scallop shells; MACN 16797, 2 egg capsules, Undine, 1925; MACN unnumbered, 2 egg capsules, 39°30'S, 56°20'W, Undine, 1925; MACN unnumbered, 1 egg capsule, 38°25'S, 56°20'W, Undine, 1925. The three last records were examined and identified by Carcelles (1944) as *A. ancilla.*

DISCUSSION

The first known description of the spawn of a species of *Adelomelon* was provided by d'Orbigny (1846; p.424) for *A. brasiliana* (Lamarck, 1811). He figured and recorded the great abundance egg capsules in the Bay of San Blas, in the Province of Buenos Aires, Argentina, during the month of February. He indicated that the diameter of the unattached egg capsule was 80–100 mm, with 15–20 embryos per egg capsule. Dall (1889, p.312) reported



Figures 9–11. *Adelomelon beckii* (Broderip, 1836) from off Cabo Frio, Brazil. **9.** Egg capsule. Scale bar = 20 mm. **10.** Recently hatched juvenile shells. Scale bar = 10 mm. **11.** Detail of the protoconch of an adult specimen. Scale bar = 10 mm.

that the spawn of *A. brasiliana* consisted of the most extraordinary egg capsule in the *Albatross* collection. Dall's description follows:

"This ovicapsule is oblate-spheroidal in shape, a view from above giving a perfect circular outline, while from the side the profile is a symmetrical oval. It is yellowish in color but nearly transparent, thin, with a smooth, polished surface like that of wet gelatine, and possesses considerable rigidity" (Dall, 1889). He also observed that: "It was filled with a fluid, probably not very different from sea-water, and contained a single bubble of air, which, by its lightness remaining in the dome of the capsule, just about counterbalanced the weight; so that, without rising to the surface, the capsule would float in the sea at a moderate depth". In view of our findings, we suggest that this latter statement is incorrect. We examined hundreds of egg capsules of *A. brasiliana* immediately after collection. Some contained air bubbles; however, air infiltration clearly took place after removal from seawater. If the capsule wall is cracked, liquid is lost and air enters the egg capsule. Furthermore, in nature, the egg capsules do not float or drift in mid-water. The egg capsules of *A. brasiliana* are a common by-catch of shrimp trawlers that fish along the bottom, over which the unattached egg capsules slowly drift. Unfortunately, Dall's (1889) proposition about air inside the capsules was accepted by Marche-Marchad (1968b), who hypothesized about a possible South American origin for West African volutes, with transport from east to west facilitated by the alleged "pelagic transport" of egg capsules of *Adelomelon*. Bondarev (1995) has also adopted this inaccurate assumption.

To add to the confusion surrounding egg capsules of South American volutes, Clench and Turner (1964) reproduced a figure by d'Orbigny (1846), which incorrectly illustrates the egg capsule of *Zidona dufresnei* as being one of *A. brasiliana*. Furthermore, Knudsen (1993) erroneously stated that the egg capsule of *A. brasiliana* has a flattened base. De Mahieu et al. (1974) and Penchaszadeh and De Mahieu (1976) measured and analyzed hundreds of egg capsules of *A. brasiliana* from the Mar del Plata region, off Argentina. The spherical egg capsules had diameters of 40–80 mm, and an internal volume of up to 140 ml. The number of embryos found per egg capsule was 9–33 (Carcelles (1944) had reported 5–15 embryos per capsule). The uncleaved egg measured 240 μm diameter, and no nurse eggs were present. Apparently, embryos fed on albumen and amino acids present in the intracapsular fluid and internal wall of the egg capsule.

In the past, several different egg capsules were believed to belong to *A. ancilla*. Carcelles (1944) erroneously assigned spherical, bottom-attached egg capsules covered with a calcareous wall (characteristic of *Odontocymbiola magellanica*, see figures 11–12) to *A. ancilla* (MACN 16797). Penchaszadeh and De Mahieu (1976) repeated the mistake made by Carcelles in his description. The egg capsules studied by Carcelles possibly belong to *O. magellanica*, which lives in deeper waters off Rio de la Plata. The egg capsules of *O. magellanica* studied by Penchaszadeh and De Mahieu (1976) came from Gulf San José and Gulf Nuevo, in northern Patagonia, Argentina, 814 m depth. Geographic variation could be relevant to the differences in numbers of hatchlings per egg capsule found by Carcelles (n=19–22) and Penchaszadeh and De Mahieu (n=6–10). This variation could be related to differences in female size, geograph-

Table 1. Summary of the reproductive attributes of *Adelomelon beckii* and *Adelomelon ancilla*. Numbers in parentheses indicate range.

Attribute	*Adelomelon beckii*		*Adelomelon ancilla*	
Shape and mode of attachment of egg capsule	Globose Attached to hard substrate		Flat oval Attached to hard substrate	
Diameter of egg capsule (mm)	Base 48.8 ± 2.2 (46–51) n = 4	Height 34.3 ± 1.5 (32–35)	Base (max.) 40.3 ± 3.4 (27–46) Base (min.) 37.4 ± 4.2 (25–44) n = 41	Height 6.0 ± 1.3 (4–9) n = 17
Internal volume of egg capsule (ml)	30–35		2.5–4.0	
Number of embryos per capsule	7–9		5.5 ± 1.8 (2–8) n = 20	
Egg diameter (μm)	Unknown		60–71	
Shell length at hatching (mm)	17.2 ± 1.0 (16.0–18.6) n = 7		12.1 ± 0.4 (11.4–12.7) n = 8	
Hatching mode	Crawling juvenile (direct development)		Crawling juvenile (direct development)	
Number of shell whorls at hatching	3		2.5	

ic variation, or the existence of a so far undetected cryptic species. However, the egg capsules of all material of *O. magellanica* examined consisted of an attached spherical case covered by a white external calcareous layer. *Adelomelon ancilla* has an attached, very flat, expanded egg capsule with no calcareous wall.

By re-evaluating old descriptions of South American volutids, we are able now to recognize that the egg capsules attributed by Strebel (1906, figs. 10, 52, and 52a) to *Adelomelon ancilla* (as *Voluta ancilla*), are indeed the egg capsules of that species. However, Strebel also incorrectly assigned egg capsules of several other species, of different sizes and shapes, to this latter species. The early anecdotal description made by Captain Duhaut-Cilly of the egg capsule of *Odontocymbiola magellanica* from the Magellan Strait (and repeated by Lesson (1840)), "a round membrane, slightly convex, very similar to a watch cover glass", could very well represent the egg capsule herein described for *A. ancilla*. The egg capsules of *A. ancilla* are indeed more similar to the egg capsules described for *Zidona dufresnei* than to those of *O. magellanica* (see Penchaszadeh and De Mahieu, 1976).

The material assigned by Dall (1889) to *O. magellanica* does not agree with the shape or size of the egg capsules of this species as we know it. The capsules examined by Dall lacked the external calcareous layer. According to the shape, size, and number of embryos (2–4), it is plausible that Dall (1944) had referred in this case to the egg capsules of *Zidona dufresnei* (as described by d'Orbigny, 1846 and Penchaszadeh and De Mahieu, 1976). The egg capsules that Arnaud (1978) ascribed to *Harpovoluta charcoti* resembles those of *Zidona dufresnei*, and not those of *O. magellanica*, as Arnaud suggested, probably following Dall's (1889) erroneous identification of the species.

Reproductive traits of South American volutes for which the reproduction has been studied (Table 2) separate very clearly these species from the West African and the Indo-Pacific members of the family (Marche-Marchad, 1968a, 1980; Smith, 1910; Tokioka, 1962; Cotton, 1937, 1944; Knudsen, 1993). Most South American

→

Figures 12–14. *Adelomelon ancilla* (Lightfoot, 1836). **12.** Lateral view of an egg capsule detached from the substrate. Scale bar = 10 mm. **13–14.** Views through the transparent base of the egg capsule. Scale bar = 10 mm.
Figures 15–17. *Adelomelon ancilla* (Lightfoot, 1836) from off Río de La Plata, Argentina. **15–16.** Shell of a recently hatched juvenile. Scale bar = 5 mm. **17.** Protoconch of an adult shell. Scale bar = 6 mm.
Figures 18–19. Volutid egg capsules. **18. (A)** Capsules of *Odontocymbiola magellanica* (Gmelin, 1791) and **18. (B)** *Adelomelon ancilla* (Lightfoot, 1836) attached to a valve of *Zygochlamys patagonica* from off Río de la Plata, Argentina. Scale bar = 25 mm. **19.** Detail of the capsule of *O. magellanica*, covered by a calcareous layer. Scale bar = 20 mm.

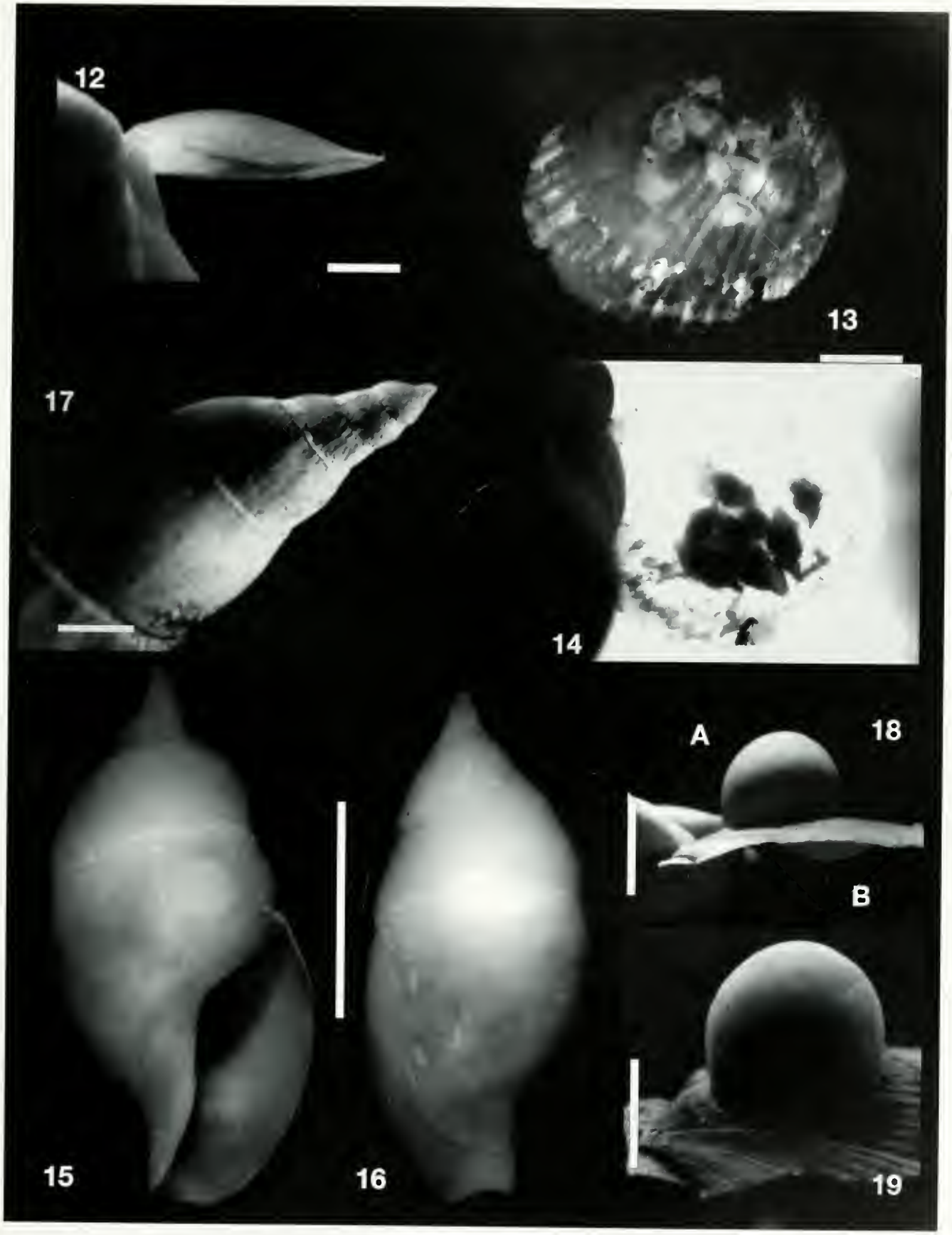

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Table 2. Summary of information on the egg capsules in the family Volutidae.

Southwest Atlantic and Caribbean, Subantarctic and Antarctic	Eastern Atlantic	Indo- West Pacific and Australia
Adelomelon, Odontocymbiola, Zidona, Harpovoluta, Provocator, Voluta (musica)	*Cymbium*	*Melo*
Penchaszadeh and de Mahieu (1976), Arnaud and Van Mol (1979), Clench & Turner (1964), present study	Marché-Marchad (1968a, 1980)	Smith (1910), Tokioka (1962), Cotton (1937, 1944), Knudsen (1993)
Spawn is a single egg capsule; generally attached by flat base to hard substrates; lens-shaped, hemispherical, or spherical	Spawn is a single spherical egg capsule with a very thin wall. It is incubated on the foot of the female	Spawn roughly cylindrical (pineapple-shaped), consisting of about 100 individual egg capsules spirally arranged, central space present
Between 2–33 eggs per capsule, variations intra and interspecies	Between 4–46 eggs per capsule, intra- and interspecific variation occur	Single embryo per egg capsule
Uncleaved egg diameter between 60–300 μm depending on species	Diameter of the developing egg around 100 μm	No information available
No nurse eggs (°). Supplementary food for the embryos present as albumen in intracapsular liquid and inner capsule membrane	About 100,000 nurse eggs per egg capsule; albumen present in intracapsular liquid	No nurse eggs reported. Apparently albumen present in intracapsular liquid
Hatching as crawling juveniles (direct development)	Hatching as crawling juveniles or large veliconch	Hatching as crawling juveniles (direct development)

(°) If nurse eggs are confirmed in *Voluta virescens*, as stated by Bandel (1976), this would be an exception for this group.

volutes have flat, hemispherical, or spherical attached egg capsules (with the exception of *A. brasiliana*, which has a non-attached, spherical capsule), with 2–33 eggs per capsule, egg diameter usually of 90–300 μm (60–71 μm in *A. ancilla*), and direct development. In addition to yolk, albumin, amino acids, and carbohydrates are consumed by the embryos. No nurse eggs are present. South American members of the subfamily Volutinae apparently represent an exception to the above (e.g., *Voluta virescens*, Bandel, 1976).

When the reproductive strategies of our study animals are compared to those described for volutids from West Africa and the Indo-Pacific, several major differences become apparent. The spawn in the genus *Cymbium* Roding, 1798 (West Africa), following the description by Adanson (1757) was at first thought to be viviparous. The spawn of this species was later described by Marche-Marchad (1968a, 1980) as consisting of one spherical egg capsule with very thin walls, measuring 3–4 cm diameter and containing a very dense liquid (albumin). The developing eggs measured around 100 μm and up to 100,000 nurse eggs measuring in average 150 μm were present. The egg capsules are brooded by the female in a "brooding sac" located on the foot. Hatchlings are released as veliconch larvae, their shell measuring 20–50 mm (Marche-Marchad, 1968a, 1980). The number of developing embryos is 4–46, depending on the species and the female size. The developmental time until hatching may be as long as 5 months.

The Indo Pacific species *Melo miltonis* (Griffith and Pidgeon, 1834), *M. umbilicata* Broderip in Sowerby I, 1826, *M. ducale* (Lamarck,1811), and *M. melo* (Lightfoot, 1786) have been studied respectively by Cotton (1937, 1944) Knudsen (1993), Allan and Middleton (1946), Tokioka (1962), and Amio (1963). The spawn in all these species consists of egg masses, roughly cylindrical, with a variable number of egg capsules spirally arranged. The egg mass in these different species have an empty, central space that is connected to the exterior by a number of fontanels between the bands of egg capsules. These egg masses are attached to hard substrata by a base and may reach large sizes (e.g., 20 cm in *M. miltonis* and 25 cm in *M. ducale*). Only a single embryo develops inside each capsule. The egg diameter and type of extra-embryonic nutrition have not been studied. Hatchlings are released as crawling juveniles.

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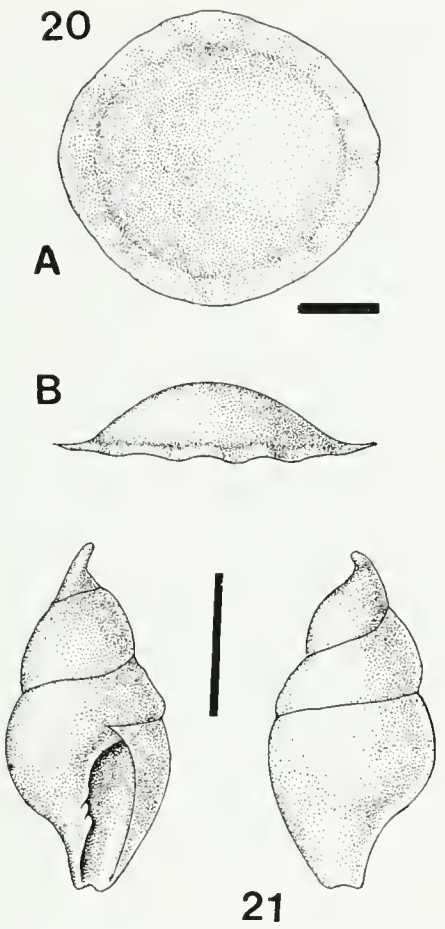

Figures 20–21. *Adelomelon ancilla* (Lightfoot, 1836) from off Río de la Plata, Argentina. **20.** Dorsal **(A)** and **(B)** lateral views of egg capsule. Scale bar = 10 mm. **21.** Shell of a recently hatched juvenile. Scale bar = 5 mm.

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Reassignment of *Henrya morrisoni* Bartsch, 1947 from the Family Aclididae to the Ebalidae (Gastropoda: Heterobranchia)

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ABSTRACT

Henrya morrisoni Bartsch, 1947, originally assigned by Bartsch (1947) to the family Aclididae, is herein placed in the family Ebalidae. *Henrya morrisoni* is a cryptic, minute gastropod possessing a complex jaw apparatus. This apparatus, consisting of a single pair of elongate hooks, hook elements, and muscular base, is characteristic of the family Ebalidae (e.g., *Ebala nitidissima*). The infaunal *H. morrisoni* is a simultaneous hermaphrodite, with sperm morphology typical of basal heterobranch gastropods. The family Ebalidae is a sister taxon of the Pyramidellidae, superfamily Pyramidelloidea.

Key words: Anatomy, functional morphology, systematics, Pyramidelloidea, Heterostropha.

INTRODUCTION

In 1994, Warén assigned the extant genera *Ebala* Gray, 1847, *Henrya* Bartsch, 1947, *Murchisonella* Mörch, 1875, and the fossil genus *Donaldina* Knight, 1933 to his then newly named family Ebalidae. Previously, these taxa were placed in Aclididae and Pyramidellidae solely on the basis of shell characters. Warén (1994) demonstrated that, unlike pyramidellids, which possess a very diagnostic buccal stylet (Maas, 1965; Wise, 1996), these snails possess a complex jaw apparatus. Recent European species of Ebalidae live in shallow-water lagoons, estuaries, and seagrass beds (Warén, 1994).

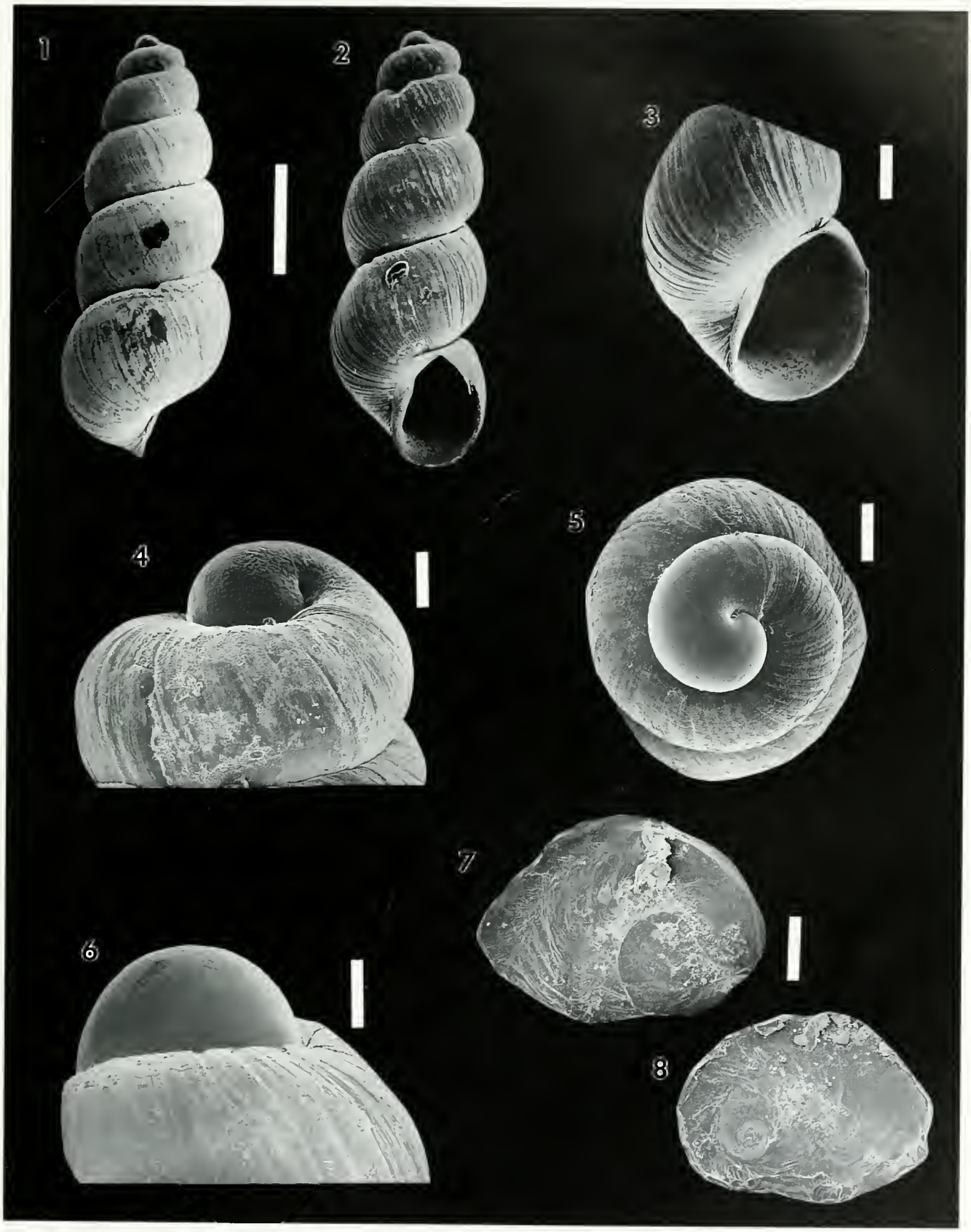
Our understanding of ebalid life history is limited to a single species. Rasmussen (1944) described and illustrated the egg capsules, embryonic development, and veliger larval stage of *E. nitidissima* (Montagu, 1803), from specimens that he collected at Isefjord (Sealand), Denmark in 5–7 m (see Rasmussen for list of other European localities). This species, which is usually found in association with *Zostera* beds, is very abundant during its spawning season (May–June). Thorson (1946) described the sinistral, planorbiform larval shells of *E. nitidissima*, as well as the external morphology of its veliger larva. Healy (1993) examined the sperm morphology of *E. nitidissima* and determined that its nucleus is elongate, strongly keeled, and almost completely penetrated by the axoneme/coarse fiber complex. In contrast, members of the Pyramidellidae have a short nucleus, with one or more strong helical keels and a shallow basal invagination, which contains only the centriolar derivative and proximal portion of the axoneme/coarse fiber complex. Huber (1993) examined the nervous system of *E. nitidissima* (then assigned to the family Pyramidellidae) and determined that it is significantly different from the other pyramidellids he investigated. The eyes of *E. nitidissima*, unlike those of pyramidellids, are attached to the cerebral ganglion by the optic nerves. These and other differences in their respective nervous systems (Huber, 1993) and sperm morphology (Healy, 1993) further support the separation of Ebalidae and Pyramidellidae.

J. P. E. Morrison collected specimens of Henrya morrisoni from the drift line off a "mangrove swamp" on Shell Key, off St. Petersburg, Florida in April, 1936. Subsequently, this species was named and assigned to the Aclididae by Bartsch in 1947. Bartsch described the shell of the new species as very minute, pupoid, very slender, and milky white, with its nucleus consisting of a single, strongly rounded, hyaline whorl forming a very blunt apex. Postnuclear whorls were characterized as high between summit and suture, strongly rounded, and marked by conspicuous growth lines. See discussion on Bartsch's reasons for assigning this taxon to this family under Taxonomic Remarks below.

This study was undertaken to provide insight into the morphology and systematic position of *Henrya morrisoni*.

MATERIAL AND METHODS

The author (see HMNS material below) collected specimens of *Henrya morrisoni*. Samples of the top 5–15 cm of mostly mud substratum were sieved through a 0.5 mm sieve, rinsed with seawater, and the remaining fraction sorted under a dissecting microscope. Snails were kept alive in small bowls of aerated seawater.



Figures 1–8. Scanning electron microphotographs of shell and operculum of *Henrya morrisoni*. **1.** Apertural view. **2.** Dorsal view. Scale bars = 250 μm. **3.** Enlargement of aperture. Scale bar = 100 μm. **4.** Apical view of protoconch. Scale bar = 30 μm. **5, 6.** Lateral views. Scale bars = 30um. **7, 8.** Operculum. **7.** Attachment side. **8.** Unattached side. Scale bars = 100 μm.

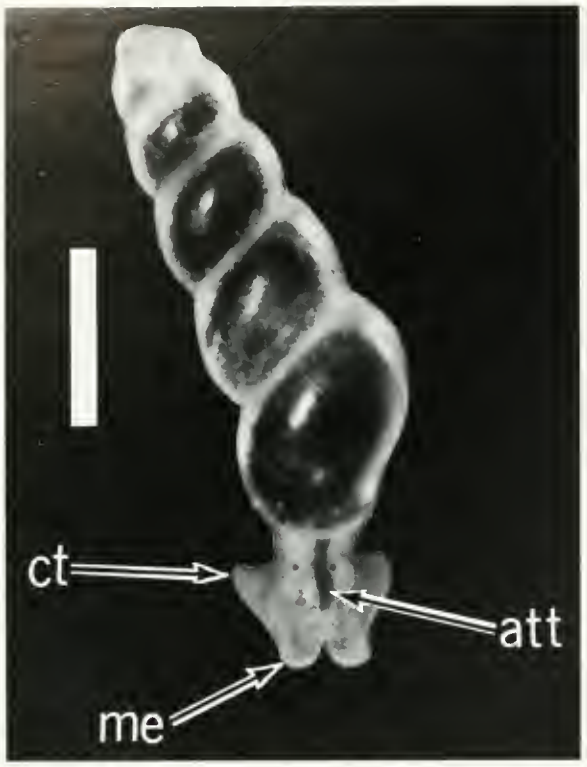


Figure 9. Living *Henrya morrisoni*. Scale bar = 300 µm. att = anterior alimentary tract, ct = cephalic tentacle, me = mentum.

Morphology

Light Microscopy

a) Photography: Living snails were photographed with a Pentax 35 mm camera mounted on a Zeiss Tessavar dissecting microscope.
b) Dissections: Snails were dissected whole, once their shells were cracked with forceps and shell fragments removed. Whole animals and/or their alimentary and reproduction systems (after excision) were stained with toluidine blue. Line drawings were produced under a dissecting microscope equipped with drawing tube.

Scanning Electron Microscopy

Opercula and shells were cleaned by sonication, air-dried, coated with gold-palladium, and examined under Selectron 250 or JEOL JSM-6100 scanning electron microscopes operating at 5–10 KEV.

Museum material examined: USNM 466297, 5 shells, [not 11, as stated by Bartsch (1947)], type locality; USNM 466225, 1 specimen, Morrison station 14, upper line of drift along mangrove swamp, Shell Key, St. Petersburg, Florida; HMNS 46019, 2 specimens, May, 1994, HMNS 46020,1 specimen, Feb. 1996; both lots from junction of Pine Island and Bayou roads, off Florida State Highway 550, near Brooksville, Florida, subtidal, marsh area, J. Wise coll.

SYSTEMATICS

Subclass Heterobranchia Gray, 1840

Superfamily Pyramidelloidea Gray, 1840
Family Ebalidae Warén, 1994

Taxonomic remarks: Van Aartsen (1995) has argued that the names *Ebala* Gray, 1847 and Ebalidae Warén, 1994 are unavailable and/or invalid. He contended that the names *Anisocycla* Monterosato, 1880 and Anisocyclidae van Aartsen, 1995 should be used instead. Van Aartsen also stated that "even if one considers *Ebala* Gray, 1847 (not of Leach) a new genus as of November, 1847 [Gray, 1847b], it is still a junior homonym of *Ebala* Leach in Gray, October, 1847 [Gray, 1847a], and therefore cannot be used." This however is incorrect as the name was introduced in synonymy in October 1847 and unavailable names do not enter into homonymy (ICZN, 1985, Article 54). As outlined by Warén (1994), the genus *Ebala* should date from Gray (1847b) with the type species as *Turbo nitidissima* Montagu, 1803. Mr. P. K. Tubbs, Secretary of the International Commission on Zoological Nomenclature (ICZN) (Warén, pers. comm.), confirmed this conclusion. Warén (1994) further demonstrated that *Anisocycla* Monterosato, 1880 is a replacement name for *Aciculina* Deshayes, 1862.

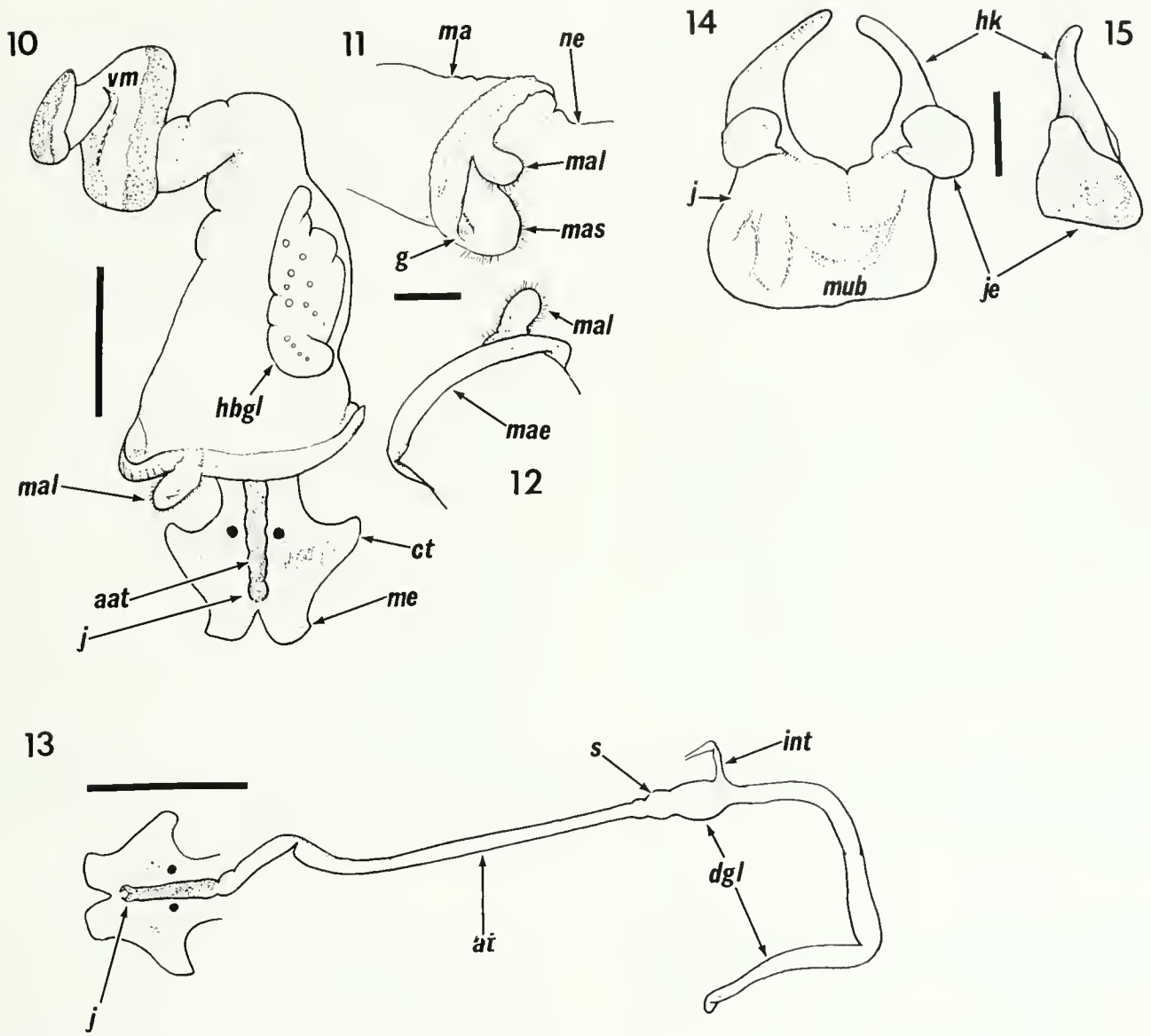
Recently, Le Renard (1998) discussed the various uses of the names *Ebala* and *Anisocycla* and concluded that the later should be used, following van Aartsens's interpretation of Gray (1847b). It is beyond the intended scope of this paper to delve into the problems arising from Gray's work. It should be sufficient to state that I consider both *Ebala* and Ebalidae to be valid names as demonstrated by Warén (1994). As the Secretary of the ICZN has endorsed this position, anyone in disagreement should petition the ICZN for adoption of his or her views.

In addition, various ebalid species (e.g., *Ebala nitidissima*) have been placed in the family Pyramidellidae and typically assigned to the genera *Eulimella* or *Anisocycla* (Rasmussen, 1944; Thorson, 1946; Wilke and van Aartsen, 1998). The status and systematic position of *Eulimella* has not been examined as part of this study.

Henrya Bartsch, 1947

Type species: *Henrya henryi* Bartsch, 1947, by original designation.

Taxonomic remarks: Bartsch (1947) erected the genus *Henrya* to which he assigned the new species *henryi*, *goldmani*, and *morrisoni* (respective type localities: San Salvador, Bahama Islands; Progresso, Yucatan, Mexico; and Florida [see above]). Essentially, he separated these taxa using interspecific differences in shell diameter. Bartsch placed them in the family Aclididae because of



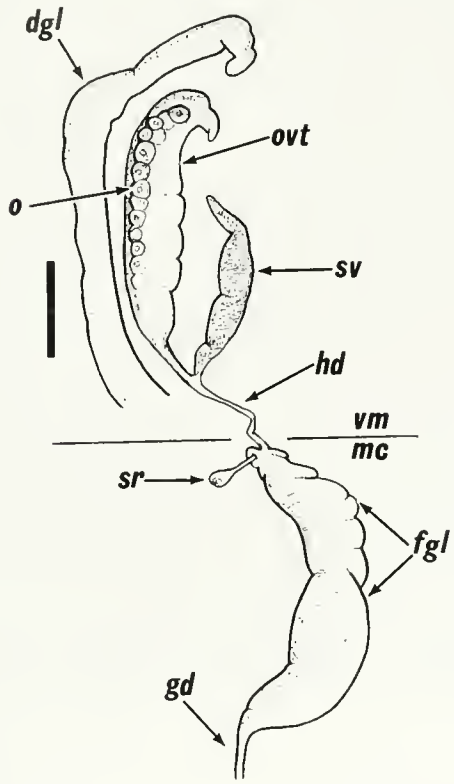
Figures 10–15. *Henrya morrisoni.* **10.** External anatomy of *H. morrisoni.* Scale bar = 300 μm. **11.** Right mantle edge and siphon. Scale bar = 125 μm. **12.** Dorsal view of mantle edge and lobe. Scale bar = 125 μm. **13.** Diagram of alimentary tract. Scale bar = 300 μm. 14, 15. Jaw apparatus. **14.** Schematic view. **15.** Single hook. Scale bars = 10 μm. aat = anterior alimentary tract, at = alimentary tract, ct = cephalic tentacle, dgl = digestive gland, hbgl = hypobranchial gland, hk = hook, int = intestine, j = jaw, je = jaw element, ma = mantle, mae = mantle edge, mal = mantle edge lobe, mas = mantle edge/siphon, me = mentum, mub = muscular base, ne = neck, s = stomach, vm = visceral mass.

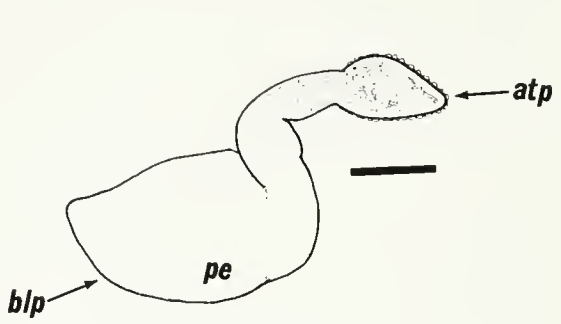
their shell morphology and small size (generally < 2 mm).

Henrya morrisoni Bartsch, 1947

Henrya morrisoni Bartsch, 1947:14–15, pl. 3, fig. 1. (Holotype: USNM 573636 (lost), type locality, J. P. E. Morrison's station 15, in drift at edge of a mangrove swamp, Shell Island, off St. Petersburg, Florida); Abbott, 1974:133.

Description: *Shell and operculum (Figures 1–8):* Shell elongate, transparent, thin and fragile, to 1.25 mm in length, with 4–5 teleoconch whorls (figures 1, 2). Teleoconch whorls convex, with moderately shallow sutures and numerous, fine axial growth lines. Body whorl 50 to 55% of shell length. Umbilicus absent. Aperture elongate-ovate to round (figure 3). Sinistral, smooth protoconch, with lower portion sunken in first teleoconch whorl (figures 4–6). Operculum horny, translucent operculum, ovate and closing aperture (figures 7, 8).
Head-foot and visceral mass (Figures 9, 10): Head grey to golden brown, with anterior region of alimentary tract





Figures 16, 17. *Henrya morrisoni.* **16.** Reproductive tract. Scale bar = 100μm. **17.** Diagram of penis. Scale bar = 10 μm. atp = anterior tip of penis, blp = bulbous base of penis, dgl = digestive gland, fgl = female glands, gd = gonoduct, hd = hermaphroditic duct, sr = seminal receptacle, sv = seminal vesicle, gd = gonoduct, mc = mantle cavity, o = egg, ovt = ovotestis, pe = penis, vm = visceral mass.

visible by transparency as very distinctive, medial black stripe extending from area just behind mentum notch onto neck (figures 9, 10, aat). Flattened wing-like tentacles extend 90 degrees on either side of head (figure 9, et). Tentacles not joined. Tentacular pads lacking. Mentum deeply bifid and bilobed (figures 9, 10, me). Tentacles, mentum, and lateral portions of head and foot darkly pigmented. Eyes small, subepithelial, black, widely spaced, on either side of medial head stripe, with well-developed lenses (figures 9, 10). Mouth opening medially within bilobed mentum. Propodium not bifid, antero-laterally rounded. In its region behind propodium, foot narrows initially to then widen, tapering to blunt tip. Both mentum and propodium highly ciliated, with particularly long propodial cilia. Mentum stretched on substratum in region anterior to propodium in crawling animal. No attachment thread or pedal gland observed. Visceral mass (figure 10, vm) divided into digestive gland, which consists of reddish-brown, grey, or black cells and greenish-yellow reproductive tract (mostly ovotestis).

Pallial cavity (Figure 10, 11, 12): Pallial cavity, long, spacious, tapering in posterior direction, with short siphon (figure 11, mas). Dorsal surface of mantle darkly pigmented. Mantle edge (figure 12, mae) thick, finely crenulated and wide, with large, elongate lobe on right forming 45°–90° with mantle edge (figures 10, 11, 12, mal). Ventral and dorsal ciliated strips located on right side of mantle cavity, joining in posterior region. Ventral ciliated strip originates on mantle lobe. Large, elongate, yellow hypobranchial gland located on left side of mantle roof. Hypobranchial gland (figure 10, hbgl) composed of clear matrix in which large and small cells containing yellow substance are suspended. When snail is disturbed, cells release thick, pale-yellow exudate. Heart, located at right posterior of mantle cavity, consisting of single auricle and single ventricle. Gill absent. Kidney not found.

Alimentary tract (Figures 13–15): Gut extending in posterior direction as long, straight tube (figure 13, at) from between mentum lobes to stomach, which is located within visceral mass (figure 13, s). Jaw (figures 13, 14, j) located inside buccal opening and consisting of one pair of large hooks, each with an element attached to a basal plate (figure 14, 15, je). Hooks inserted into muscular basal plates, which provide support and operation

of jaw. It is here suggested that jaw is everted on short snout through buccal aperture during feeding. Radula absent. Anterior portion of gut green, posterior section yellowish-orange. Anterior gut passing through nerve ring, within head. Small stomach anterior to junctures of digestive gland (figure 13, dgl) and intestine (figure 13, int). Intestine forming 90° with stomach, turning and extending in anterior direction parallel to gut. Rectum and anus not observed, but anus probably opening on right posterior portion of mantle cavity, on mantle floor. Digestive gland packed with mostly dark cells (a combination of red and blue cells), extending to tip of visceral mass.

Reproductive system (Figures 16, 17): Species exhibits simultaneous hermaphroditism. Elongated ovotestis (figure 16, ovt) located within visceral mass on columellar side, consisting of lobes where both eggs (figure 16, o) and sperm are produced. At lower portion of ovotestis is a short duct extending anteriorly to elongate and tapering seminal vesicle (figure 16, sv). Seminal vesicle lying parallel to ovotestis, joining hermaphroditic duct (figure 16, hd), which extends from visceral mass (figure 16, vm) into mantle cavity (figure 16, mc) to gonoduct (figure 16, gd) and female glands (figure 16, fgl). Narrow gonoduct ends on neck on right side of head. Small, round seminal receptacle (figure 16, sr) joins gonoduct through short duct in region anterior to widening of gonoduct and female glands. Penis (figure 17, pe) with tapered, round anterior tip (figure 17, atp) and long neck that extends in posterior direction to form bulbous base (figure 17, blp). Protrusible penis extends from body through medial opening ventral to mentum. Vas deferens not observed. Egg and larval development unknown.

CONCLUSIONS

The infaunal and diminutive snail *Henrya morrisoni* inhabits the tidal marshes of southern Florida. It was first described from its shell only by Bartsch (1947) who assigned the species to the family Aclididae. The present findings, when compared with those of Warén (1994; pers. comm.) and Rasmussen (1944), indicates that this species should be reassigned to the family Ebalidae Warén, 1994. This species, like those described by Warén (1994), have a diagnostic jaw apparatus. Its jaw, consisting of a single pair of hooks, supporting elements, and a muscular base, is similar to that of *E. nitidissima*. Moreover, the external anatomy (e.g., tentacle shape, mentum configuration, anterior alimentary tract delineated by black stripe, etc.) of *H. morrisoni* closely resembles that of *E. nitidissima* (Rasmussen, 1944). Consequently, the allocation of this taxon to the family Ebalidae is unequivocal.

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I would like to thank Dr. Robert Bullock for calling my attention to these snails and for disclosing their location. I am grateful to Dr. John Hicks and Mr. Jim Barrish of the Texas Children's Hospital, Houston, Texas for SEM time and darkroom expertise. I also thank Dr. A. Warén for providing his thoughts on this matter and his unpublished data. Mr. Richard Petit provided very useful insight into the nomenclatural confusion concerning generic and familial names. The critical comments of the anonymous reviewers improved this manuscript. Lastly, none of this would have been possible without Dr. M. Rice and her staff at the Smithsonian Marine Station at Fort Pierce, Florida. This paper is Smithsonian Marine Station Contribution no. 477.

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Book Review

The Freshwater Mussels of Tennessee

by Paul W. Parmalee and Arthur E. Bogan, 1998. University of Tennessee Press, Knoxville. xii, 1–328, 133 pls, 130 maps.

In the arena of systematic revisions and faunal reviews, freshwater malacology has always been behind the marine malacological community for several decades or more. The pioneering studies of Ortmann in Pennsylvania were fitfully followed by similar works on Missouri, Indiana, and a paltry few other states. It is only very recently that monographic-scope works on freshwater mussels have finally come into their own. This book brings freshwater malacology into the same league as marine malacology.

One of the quirks of freshwater malacology is its insistence to cover not a meaningful biogeographic region such as the Holarctic, or the Ohio River basin, but the meaningless arbitrary unit of The State, no matter whether a large state (Texas) or a small one (Vermont) is concerned. This cycle seems unalterable, as nearly all of the most recent works have been at the state level, and nearly all planned ones will be as well. Parmalee and Bogan's book is no exception; it deals with Tennessee. But here it fares better than most because of the nature of the state's boundaries. Within Tennessee is a portion of the Mississippi River, with all of its big river and bayou taxa. More importantly, Tennessee is located predominantly in the Tennessee and Cumberland River basins—those wonderfully diverse systems that have elements of the Ohio River fauna plus numerous endemics. Finally, tucked in the southeastern corner is the Conasauga River, a lone portion of the Mobile River system, with its very unique fauna. As such, Tennessee has (or had) within its borders nearly half of all of the recognized unionoid taxa in North America. For this reason, this book is useful far outside of the boundaries of the State of Tennessee.

There is a lot to like about this book. As with many malacological works that emerged on the market in recent times, it has a colorful, appealing format catering to more than just professional malacologists. Introductory chapters range from adequate to excellent. The section on ecology is rather brief, and is concerned mainly with causes for mussel decline rather than the ecological requirements of the animals. However, the section on aboriginal exploitation is excellent and represents an aspect of these animals often neglected in other works. A concise history of the classification of freshwater mussels provides a useful basis to understanding the systematics of the group. Readers already familiar with Dall, Bartsch, and Pilsbry are introduced to those other giants of American malacology: Ortmann, Call, and Lea. The section on diversity is an excellent backdrop to the book, bringing together information on the hydrology, topography, and biogeography of the Tennessee river systems. Most of the book is devoted to species accounts, which are mercifully arranged in alphabetical order of scientific names. Each species is represented by a small color plate that depicts both the inside and outside of the shell and that illustrates sexual dimorphism as well. Each species has its own dot distribution map with a smaller map indicating the total range of the species. Plates and maps are conveniently arranged with the text to each species, rather than gathered in the back. The authors have laboriously assembled primary synonymies that are backed by an extensive literature cited section. For each species, sections are included for distribution, description of the shell, life history and ecology, and its legal status. Introduced *Corbicula* and *Dreissena* are covered as well.

For its size, errors are few. Perhaps my main criticism is with their use of type localities. For example, under *Arcidens confragosus* (Say, 1829) they give "Bayou Teche." But Say's original localities were the Wabash River (later emended by Say to the "Fox River") and "New Orleans" (emended to "Bayou Teche"). By choosing Bayou Teche as "type locality," Parmalee and Bogan have restricted the type locality—but did they mean to do so? On several occasions the authors ignore the type designations (and therefore the type locality designations) made by other workers. For *Ptychobranchus fasciolaris* (Rafinesque, 1820), the authors give the type locality as the Muskingum River, although the lectotype selected by Johnson and Baker (1973) is from the Kentucky River. Whether the authors have reason to doubt or ignore these designations is not stated.

Although the authors describe each species, what is missing is a diagnosis that would allow separation of a species from its lookalikes. For example, several closely related taxa of *Pleurobema* that have never been adequately differentiated are found in the Conasauga River. Yet the authors only comment that "it is nearly impossible to identify and separate many individuals." This is no help to the reader. The authors could have greatly increased the worth of this book by giving the reader some simple guidelines for differentiating each species.

The synonymies are invaluable, but occasionally lack justification. *Unio nobilis* Conrad, 1854, has recently been resurrected as a valid species, yet Parmalee and Bogan synonymize it [in part] with *Quadrula apiculata* (Say, 1829). In view of the renewed interest in this species, some mention should have been made as to why they felt this course was correct. Similar unsupported synonymies are found under *Elliptio arctata* (Conrad, 1834) and *Lampsilis altilis* (Conrad, 1834), which probably represent species complexes. Under *Villosa iris* (Lea, 1829) they synonymize without comment *Unio si-*

mus Lea, 1838, which was recently resurrected and placed in *Venustaconcha* by Gordon (1995). Other synonymies may leave the reader confused. Under *Lampsilis abrupta* (Say, 1831) we find the name *Unio orbiculatus* Hildreth, 1828, which would seem to have priority over *Unio abruptus* Say, 1831. But no explanation is given why Hildreth's name is not used (Hildreth's specimen was actually *Obovaria subrotunda* (Rafinesque, 1820), and the synonymy should read "*Unio orbiculatus* of authors, not Hildreth, 1828").

Despite these rather specific criticisms, this book represents the state-of-the-art in freshwater malacological guides. Government agencies and conservation groups will embrace the maps and plates, and malacologists will continue to argue over the synonymies. This promises to be a landmark book in its field.

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Notices

OPINIONS PUBLISHED IN THE BULLETIN OF ZOOLOGICAL NOMENCLATURE

The following opinions were published on 31 March 1999 in Vol. 56, Part 1, of the Bulletin of Zoological Nomeclature. Copies of these Opinions can be obtained free of charge from the Executive Secretary, International Commission on Zoological Nomenclature, c/o The Natural History Museum, London, Cromwell Road, London SW7 5BD. U.K. (iczn@nhm.ac.uk).

OPINION 1913. *Pila* Röding, 1798 and *Pomacea* Perry, 1910 (Mollusca, Gastropoda): placed on the Official List, and AMPULLARIIDAE Gray, 1824: confirmed as the nomenclaturally valid synonym of PILIDAE Preston, 1915.

OPINION 1914. *Belemnotheutis* Pearce, 1842, *Geopeltis* Regteren Altena, 1949, *Geoteuthis* Münster, 1843, *Jeletzkyteuthis* Doyle, 1990, *Loligosepia* Quenstedt, 1839, *Parabelopeltis* Naef, 1921, *Paraplesioteuthis* Naef, 1921 (Mollusca, Coleoidea): conserved, and the specific name of *Belemnoteuthis* (sic) *montefiorei* Buckman, 1880: conserved.

In Memoriam

Sally Diana Kaicher

February 19, 1922

—

March 29, 1999

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Manuscripts: Each original manuscript and accompanying illustrations should be submitted in triplicate. Text must be typed on one side of 8½ × 11 inch white paper, double spaced throughout (including literature cited, tables and figure captions), with at least 1 inch of margin on all sides. All pages must be numbered consecutively. If printed on a word processor, the right margin should be ragged rather than justified. Authors should follow the recommendations of the *Scientific Style and Format—The CBE Manual for Authors, Editors, and Publishers*, which is available from the Council of Biology Editors, Inc., 11250 Roger Bacon Drive, Suite 8, Reston, VA 20190, USA (http://www.cbe.org/cbe). The first mention of a scientific name in the text should be accompanied by the taxonomic authority, including year. Latin names and words to be printed in italics must be underlined; leave other indications to the editor. Metric and Celsius units are to be used.

The sequence of sections should be: title page, abstract page, introduction, materials and methods, results, discussion, acknowledgments, literature cited, tables, figure captions, figures. The title page should include the title, author's name(s) and address(es). The abstract page should contain the title and abstract, which should summarize in 250 words or less the scope, main results and conclusions of the paper. The abstract may be followed by a maximum of 8 key words. All references cited in the text must appear in the literature cited section and vice versa. In the literature cited section, all authors must be fully identified and listed alphabetically. Follow a recent issue of THE NAUTILUS for bibliographic style, noting that journal titles must be unabbreviated. Information on plates and figures should be cited only if not included in the pagination. Tables must be numbered and each placed on a separate sheet. A brief legend must accompany each table. Captions for each group of illustrations should be typed on a separate sheet and include a key to all lettered labeling appearing in that group of illustrations.

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Notices

The International Code of Zoological Nomenclature

The new and extensively revised 4th Edition of the *International Code of Zoological Nomenclature* will be published in September 1999. It will come into effect on 1 January 2000 and will entirely supersede the current (1985) edition. Some notes about the forthcoming edition, which contains many new provisions, will be found on the Commission's Website (www.iczn.org).

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Description of *Haliotis fatui* new species (Gastropoda: Vetigastropoda) from the tropical western Pacific

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ABSTRACT

A new abalone species from the central Indo-Pacific is described. The species has been known for almost two decades and resulted in the introduction of a *nomen nudum*. The name is validated here as *Haliotis fatui* Geiger (*ex*-Rehder MS). The species is described from shell, radular, epipodial, and hypobranchial gland characters. It is most similar to and occurs in part of the range (Tonga, Solomon Islands, Vanuatu, and Marianas Islands) of the highly variable *Haliotis varia* Linnaeus, 1758. It differs from this latter species, however, in its shell and epipodial characters.

Key words: Abalone, Gastropoda, Haliotidae, *Haliotis fatui* new species, Indo-Pacific.

INTRODUCTION

Geiger (1998a) recently discussed all 200 species-level taxa and the 17 genus-level taxa in the family Haliotidae Rafinesque, 1815. Most temperate species are fairly well known; some tropical species, however, pose problems in respect to their alpha taxonomy. Geiger (1998b) discussed the controversial taxon *H. clathrata* Lichtenstein, 1794 (*non* Reeve, 1846), for which Geiger and Stewart (1998) formulated Case 3036 now pending with the *International Commission on Zoological Nomenclature*. Stewart and Geiger (1999) designated a lectotype for *H. crebriseulpta* Sowerby, 1914, with a discussion on *H. clathrata* Reeve, 1846. Geiger and Groves (in press) review the fossil taxa including the few records from tropical regions. The study of tropical abalone is continued here with the introduction of a new species that has been known for almost two decades. A *nomen nudum* had been introduced twice for this species under the epithet "*fatui* Rehder" (Anon., 1981) and "*fatui* Rheder [*sic*], 1981?" (Ubaldi, 1993). Herein I clarify the systematics of this species and validate the name.

MATERIAL AND METHODS

Depository collections: AMNH, American Museum of Natural History, New York; ANSP, Academy of Natural Sciences, Philadelphia; MHNG, Muséum d'Histoire Naturelle, Genève; USNM, National Museum of Natural History, Smithsonian Institution, Washington, D.C.

Study of animals: Radula and epipodium were prepared as detailed in Geiger (1996) and Stewart and Geiger (1999). The terminology of radula parts of Hickman (1981) and Geiger (1996) is adopted.

SYSTEMATICS

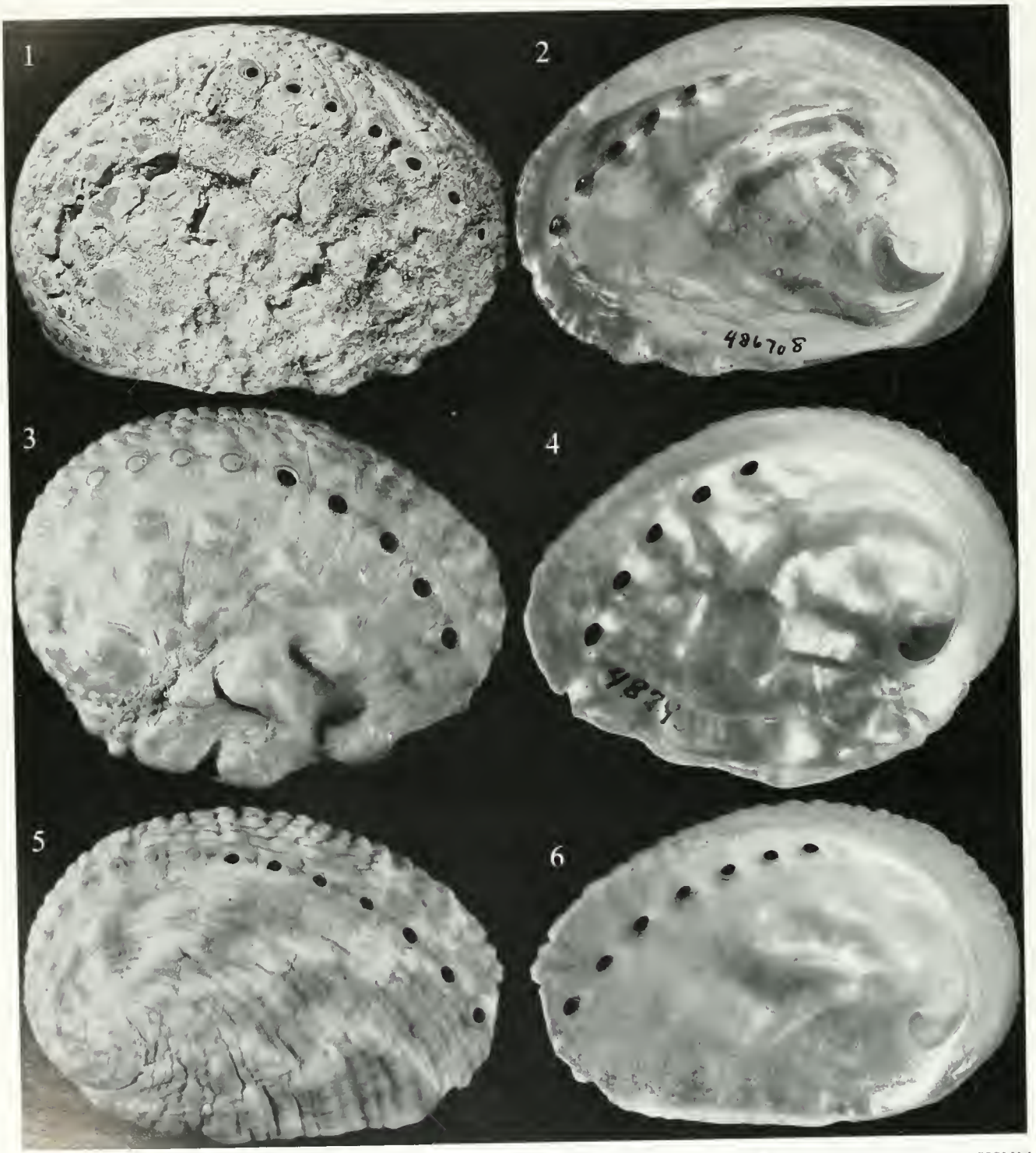
Order Vetigastropoda Salvini-Plawén, 1980
Family Haliotidae Rafinesque, 1815
Genus *Haliotis* Linnaeus, 1758

Remarks: As discussed by Geiger (1996, 1998a), there is currently no justification to subdivide the genus *Haliotis sensu lato* into subgenera. Accordingly, the species described here is placed in that large genus. Further study of the family may eventually identify distinct clades worthy of taxonomic recognition, but this stage has not yet been reached.

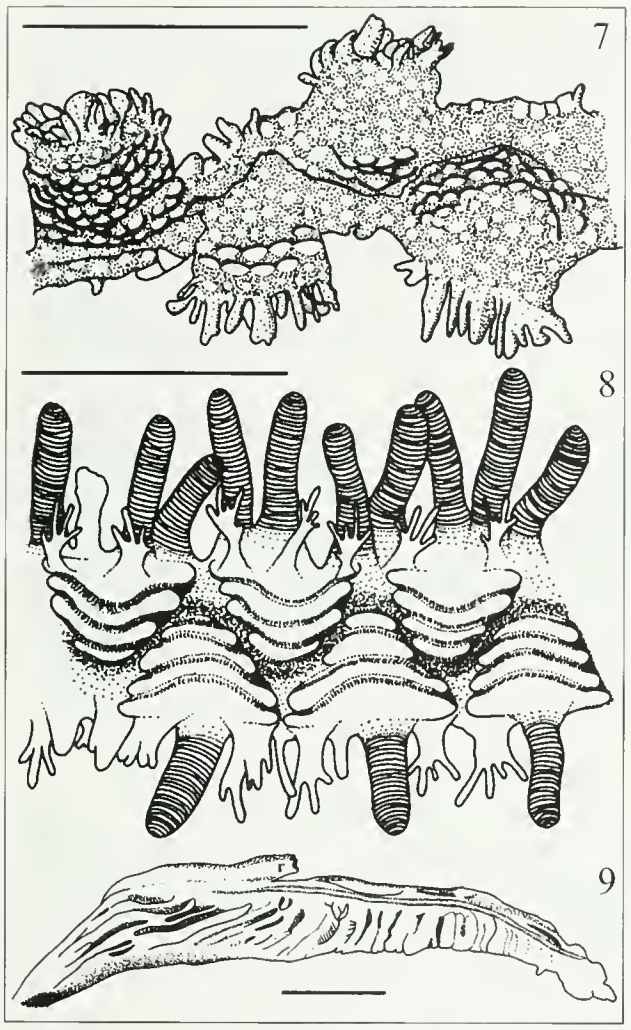
Haliotis fatui Geiger new species
(Figures 1–7, 9–16)

H. varia subspecies—Kaicher (1981: card no. 2902).
H. spiculata fatui Rehder—Anon.(1981:7) (*nomen nudum*).
H. fatui Rheder [*sic*], 1981?—Ubaldi (1993:11 3–1) (*nomen nudum*).

Description (diagnostic characters underlined): Shell medium size (to 6 cm), medium weight, somewhat arched, sub-circular to oval-oblong; strong, knobby bumps on dorsal surface of shell, usually in few, distinct, spiral rows, occasionally also in prosocline rays. Spiral threads strong, coarsely granulated. Periphery between row of holes and columella in smooth transition to dorsal surface. Holes, small, round, slightly raised. Color muddy green, brown, yellow brown. Color pattern irregular to blotchy, no spiral elements, no prosocline rays. Columella of medium width. Nacre light steel-gray. Muscle scar absent in small specimens, present in some large specimens, composed of fine, irregularly concentric ac-



Figures 1–6. Shells of *Haliotis fatui* new species. **1, 2.** Holotype, USNM 486708, 46.6 mm, Mang Island. **3, 4.** Paratype, USNM 487953, 29.5 mm, Tonga. **5, 6.** Paratype, MHNG 21226, 42.3 mm, Vanuatu. Note the variability in the extent of the bumps on the dorsal surface of the shell, and the equally variable strength of the spiral cords. The tremata are generally rather small for the genus, but note the differences between 1 and 5 as compared to 3.



Figures 7–9. Soft parts of *Haliotis fatui* new species, and *H. varia* Linnaeus, 1758. **7, 8.** Epipodia with dorsal side toward top of page. Semi-schematic, reconstructed drawings from camera lucida tracings. **7.** *Haliotis fatui*, holotype, USNM 486708. Scale bar = 5 mm. **8.** *Haliotis varia*, DLG unnumbered, Sengiggi, Lompok, Indonesia, leg. T. Baer, shell length = 27 mm. Scale bar = 2 mm. **9.** Hypobranchial gland of *H. fatui*, holotype, USNM 486708. Viewed from anterior to right side. Scale bar = 5 mm. r = rectum.

cretion lines (pathological feature?). Spire visible in ventral view.

Epipodium (Figure 7) of medium width, dorso-ventrally symmetrical, with undulating mid-epipodial fold. Face covered with low, warty tubercles, larger elements alternating dorso-ventrally. Fringe with irregular lobes, secondary short projections, denser on large elements, few between them. No hand-shaped structures, no dorsal or ventral tentacles.

Hypobranchial gland simple (Figure 9), neither secondary lamellae of the northeastern Pacific species, nor the thick lamellae of *H. asinina* (Geiger, unpubl. data).

Radula (Figure 10) slightly asymmetrical, skewed to left side. Rachidian tooth (Figure 11) somewhat narrower than first lateral tooth; cutting edge not thickened, postero-basal projection absent. Lateral tooth 1 (Figure 11) with straight primary ridge (pr), secondary ridge (sr) much smaller than primary. Lateral teeth 3–5 (Figure 12) without denticles. Marginal teeth (Figures 13–15) symmetrically denticulated.

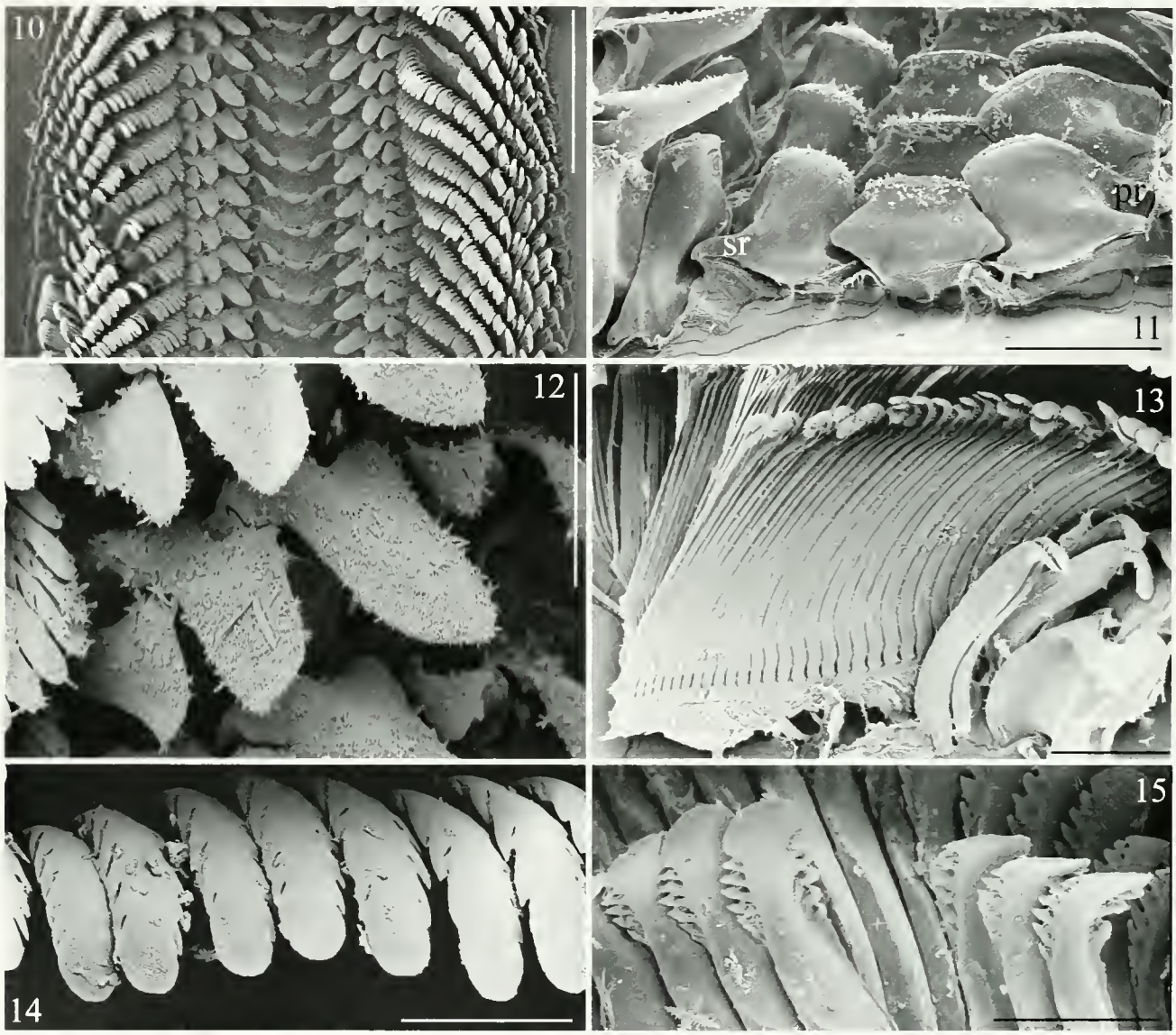
Type material: Holotype, USNM 486708, shell with animal, radula mounted on stub, desiccated and mounted piece of epipodium: Mang Island, N Marianas, 1945, leg. Banner, 46.6 mm (Figures 1–2, 7, 9–15). Paratypes, AMNH 81878, 1 shell, Santa Ana Island, Solomon Islands, Whitney South Seas Expedition 1929–1930, 58.9 mm; AMNH 81899, 1 shell, Santa Ana Island, Solomon Islands, Whitney South Seas Expedition 1929–1930, Jan. 1930, 53 mm; ANSP 284325, 1 shell, Kumbun Island, SW New Britain, ex. coll. W. E. Jamison, Nov. 1962, 40 mm; MHNG 21226, 1 shell, Vanuatu, leg. de Villoutreys, 42.3 mm (Figures 5–6); USNM 702975, 7 shells, NE Tofua Island, Ha'apai Group, Tonga, April 1971, on coral rocks off reef edge, leg. John H. Fatu, 29.3 mm, 36.4 mm, 40.4 mm, 42.2 mm, 46.9 mm, 49.2 mm, 52.7mm; USNM 702512, 9 shells, reef off Tofua Island, Tonga, April 1971, ex-L. J. Lancaster, 34 mm, 37.2 mm, 37.4 mm, 44.0 mm, 43.5 mm, 48.2 mm, 50.7 mm, 58.0 mm; 50.2 mm; USNM 487953, 1 shell, Agrigan Island, N Marianas, 29.5 mm (Figures 4–5); USNM unnumbered, 1 shell, Tonga, 53.1 mm; USNM unnumbered (ex-San Diego Society of Natural History No. 32719), 2 shells, Tonga Island, Vavau, leg.H. N. Lowe, 1924, 48.9 mm, 46.5 mm.

Type locality: Mang Island, Northern Marianas.

Distribution (Figure 16): Most specimens have been found on Tonga, with additional specimens stemming from the Solomon Islands, Vanuatu, and the Marianas Islands. An overall western-central Indo-Pacific distribution pattern seems to be emerging. From the little information available, the species seems to live in shallow coral reef habitats, which is typical for tropical abalone species (Geiger, 1996; Stewart & Geiger, 1999).

Etymology: The name honors the collector of several specimens from Tonga, John H. Fatu. The provisional name that has been associated with this species is validated, following the original intent of the late Dr. H. A. Rehder of the USNM.

Comparative remarks: The only species similar to *H. fatui* is *H. varia* Linnaeus, 1758. *Haliotis varia* is an extremely variable species and it is likely that some specimens will not be separable from shell morphology alone. The comparison provided here is between a typical *H. fatui* and a typical *H. varia*, i.e., the well-known green form of the latter species from the Philippine Islands. In *H. varia* the shell is more arched, usually heavier, and the knobs are more weakly developed than in *H. fatui*. The apertural lip is more outwardly curved in *H varia*. The holes in *H. fatui* tend to be smaller and more numerous, although this last character is extremely var



Figures 10–15. Radula of *Haliotis fatui* new species, holotype, USNM 486708. The crystalline precipitations are preparational artifacts of unknown origin. **10.** View of entire radula from anterior third of ribbon. Note slight asymmetry. Scale bar = 1 mm. **11.** Rachidian and lateral tooth 1. pr: primary ridge. sr: secondary ridge. Scale bar = 200 μm. **12.** Lateral teeth 3–5 without denticles. Scale bar = 200 μm. **13.** Face of entire left row of marginal teeth in posterior view. Larger and stronger teeth to the right are from a more inner position of the preceding row than the more slender teeth to the left. Scale bar = 200 μm. **14, 15.** Cusps of inner marginal teeth. Note symmetrical denticles.**14.** Dorsal view. Scale bar = 100 μm. **15.** Ventral view. Scale bar = 100 μm.

iable (Geiger and Groves, in press) within species. The coloration of *H. varia* consists typically of some oblique, prosocline, jagged flammules, in green tones, whereas in *H. fatui*, the distribution of pigment is rather blotchy with green and brown specimens being equally represented.

The epipodium of *H. fatui* is devoid of dorsal or ventral tentacles (Figure 7), whereas these are prominent in *H. varia* (Figure 8). Both species share alternating larger elements, but this character is also shared with a number of other abalone species. The presence of hand-shaped elements in *H. varia*, as seen in *H. unilateralis* Lamarck, 1822, and *H. clathrata* Reeve (Geiger, 1996; Stewart and Geiger, 1999), distinguishes *H. varia* from *H. fatui*. The radula of the two species are very similar to each other, as well as to other tropical species such as *H. unilateralis* (see Geiger, 1996), *H. clathrata* Reeve (see Stewart & Geiger, 1999), and *H. asinina* Linnaeus, 1758, and *H. ovina* Gmelin,1791 (see Chitramvong *et al.*, 1998). Chitramvong *et al.* (1998) noted strong differences for lateral teeth 1 and 2 based on their fig. 3C. However, their fig. 3C does not agree with their figs 3A, 3B, and 3D, which show a very different and very typical lateral tooth 1. Overall, these results corroborate indications that radular characters better define taxa above the species level (Geiger, unpublished data).

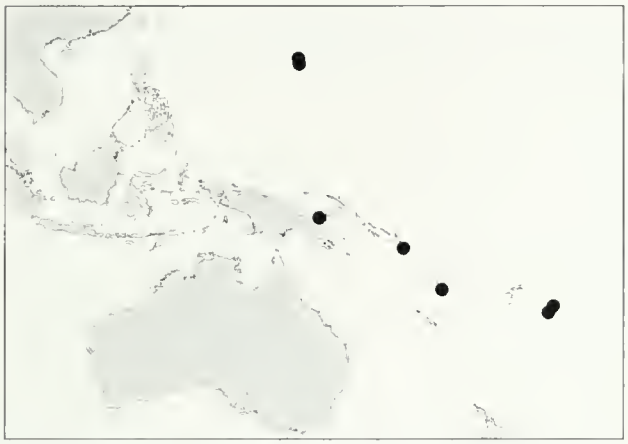


Figure 16. Map showing distribution of *Haliotis fatui* new species.

Remarks: Kaicher (1981: card no. 2902) illustrated specimens of this species. Anon. (1981), and Ubaldi (1993), both mentioned the taxon as *nomina nuda* as discussed by Geiger (1998a: note 71). The mention by Anon. (1981:7) of "*Haliotis spiculata* Reeve, 1846" actually refers to *H. sepiculata* Reeve, 1846, one of the many synonyms of *H. varia* (see Geiger, 1998a). Although most material available originates from Tonga, the Marianas Islands specimen is chosen as the holotype, because it is the sole specimen with the animal. The distribution of *H. varia* circumscribes that of *H. fatui*; hence, I do not consider *H. fatui* a subspecies of *H. varia* (cf. Kaicher, 1981), because sympatric subspecies by definition do not exist.

The specimen from USNM 702512 measuring 50.2 mm had been separated from the main lot by Rehder for designation as primary type; a handwritten label "Holotype" accompanied the specimen. This original intention of Rehder is here overridden.

ACKNOWLEDGMENTS

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The West African Rissoidae (Gastropoda: Rissooidea) and their similarities to some European species

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ABSTRACT

The family Rissoidae, which is represented by many species in temperate European and Macaronesian shore and shelf fauna, is found to be also well represented in West Africa. Eighteen species are reported, of which 10 (7 *Alvania*, 2 *Crisilla*, 1 *Zebina*) are here described as new. Only 2 species are shared with the Western European fauna, and all the temperate lineages linked to photophile algae or marine phanerogams (i.e., the genus *Rissoa*, and some lineages in *Alvania*) are missing in West Africa. Four (3 *Alvania* and 1 *Crisilla*) of the shelf species with planktotrophic larvae are closely related to a planktotrophic species of Western Europe, and this is tentatively interpreted as the result of breakup of formerly broader latitudinal ranges.

Key words: Western Africa, new species, species diversity.

INTRODUCTION

The Rissoidae are a prominent part of the littoral, shelf and upper bathyal molluscan faunas in the Mediterranean, temperate Western Europe and in the Atlantic archipelagoes: Canary Islands (Moolenbeek and Faber, 1987; Moolenbeek and Hoenselaar, 1989), Madeira (Watson, 1873), Azores (Dautzenberg, 1889; Gofas, 1990). Pallary (1920) reported twenty species along the coast of Morocco, south of Cape Spartel, but the family is believed to become abruptly impoverished further to the south. Nicklès (1950) stated that there are 6 species in 3 genera for the whole of West Africa. Individual species have later been described (Moolenbeek and Piersma, 1990; Rolán and Fernandes, 1990) but the general perception is still one of very low number of species.

The holdings in the Muséum National d'Histoire Naturelle of Paris (MNHN) include a large number of lots from West Africa, which shows that this perception is essentially a result of low sampling efforts for small continental shelf species in the past. Eighteen species are represented, of which 10 are new and will be described herein, and 4 were described in the last decade.

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MATERIAL AND METHODS

All the material examined is deposited in MNHN except where otherwise stated. Listings of material examined are arranged from North to South.

The main sources of MNHN material are:

MAURITANIA: shore collecting by P. Bouchet in 1983, and dredgings by R/V "N'Diago" by B. Richer de Forges in 1981;

SENEGAL: collections made by I. Marche-Marchad between 1953 and 1956, mostly by dredging from shore to ca. 250 m depth; some material collected by M. Pin or by K. Leung-Tak since 1980;

IVORY COAST: dredging on the continental shelf by P. Le Loeuff;

ANGOLA: collecting by the author (dredging, shore collecting and snorkling) from 1981 to 1987, jointly with the late F. Fernandes.

The remainder of the West African coast has been very poorly sampled for micromollusks, so that apparent disjunctions in the ranges are not supported by absence in a homogeneous sampling effort.

Some of the Angolan material was sieved in seawater and partly sorted *in situ*, which allowed for preparation of drawings of the living animals. This proved particularly useful for observation of color patterns and delicate structures such as pallial and metapodial tentacles, which Ponder (1985) scored as very informative taxonomic characters. Details about origin of the specimens examined for descriptions of external morphology are given in the "material examined" section of each species.

Specimens were measured with precision of 0.05 mm. Measurements of largest and smallest adult specimens or shells in each lot are given with material examined. Specimens selected for scanning electron microscopy were sonicated, and some washed in a 10% solution of sodium-lauryl sulphate.

Particular attention has been given to protoconchs as taxonomic characters at the species level. Supraspecific classification follows Ponder (1985), except for change

of rank of *Crisilla* from subgenus to genus, following Bouchet and Warén (1993).

List of abbreviations and text conventions:

coll.:	collected by
shell(s):	collected dead
specimen(s):	collected alive
sta.:	station number
AMS:	Australian Museum, Sydney
MNCN:	Museo Nacional de Ciencias Naturales, Madrid
MNHN:	Muséum national d'Histoire naturelle, Paris
UAN:	Universidade Agostinho Neto, Luanda
ZMA:	Zoölogisch Museum, Amsterdam

SYSTEMATICS

Family Rissoidae Gray, 1847
Subfamily Rissoinae Gray, 1847
Genus *Pusillina* Monterosato, 1884

Type species: *Rissoa pusilla* Philippi, 1836, by monotypy (preoccupied by *Rissoa pusilla* Grateloup, 1828, renamed *Rissoa philippi* Aradas and Maggiore, 1844).

Pusillina inconspicua (Alder, 1844)
(Figures 1–8)

Rissoa inconspicua Alder, 1844: 323, pl. 8 figs. 6–7.

Description: Shell conical, adults 1.45×0.95 to 2.75×1.7 mm. Protoconch of 3 rather convex whorls; protoconch 1 less than 1 whorl, smooth; protoconch 2 with a spiral thread running next to the suture on abapical part of whorls, and with very sinuous, indistinct growth lines on last larval whorl. Teleoconch of 2.5 to 3 whorls; spire whorls slightly convex, regularly increasing in size, sculptured with sinuous axial ribs variable in number (10 to 24 on body whorl) and development, and faint spiral cords between these ribs; body whorl with axial ribs interrupted abruptly at periphery, which leaves periumbilical area smooth. Aperture pyriform; Outer lip orthocline, smooth inner surface, thickened externally at some distance from edge by a varix of variable strength developed mostly on adapical part, then thinning out to a cutting edge. Inner lip thin, bordering a narrow umbilicus. Shell color buff, with square blotches abapically along suture; protoconch often tinged with purple or dark brown.

Head-foot with superficial black and yellow pigmentation; black marks on upper midline of propodium and on anterior part of opercular lobes, on more intensely pigmented specimens also on sides of propodium and over posterior part of head. Tentacles cylindrical, with an axial series of yellow blotches; eyes in a small bulge at base of each tentacle. Snout bilobed, with a yellowish buccal mass visible by transparency. Yellow granular masses behind each eye; other more irregular superficial yellow marks on snout, propodium, opercular lobes (behind black area) and sometimes on periphery of foot sole. A deep yellow or orange bar visible by transparency beneath operculum. Single metapodial tentacle rather slender. Sole of foot colorless or with few peripheral yellow marks, with posterior pedal gland apparent around a small longitudinal slit. Right pallial tentacle small, colorless with a yellow blotch at its base; left pallial tentacle not detected, a yellow blotch present at its expected location.

Type locality: Northumberland coast (NE Great Britain), "in deepish waters among corallines".

Material examined: Western Europe: Malaga (Spain), in coarse sand 20–40 m, 100 shells (1.35 × 0.85 to 2.55 × 1.5 mm), coll. Gofas, Sept. 1990; Sagres (Portugal), on coarse sand near cliffs 17–23 m, 11 specimens (1.3 × 0.85 to 1.8 × 1.1 mm), mission Algarve, May 1988; and several hundred specimens from throughout the range. Mauritania: 3 miles W of Kiaoué (20°02′N, 16°22′W), 1 shell (1.85 × 1.25 mm), coll. Marche-Marchad, May 1965; Port Etienne (now Nouadhibou, 20°20′N, 16°22′W), 10 m, 64 shells (1.5×0.95 to 2.25×1.35 mm), coll. Marche-Marchad, May 1965; Baie de l'Etoile, 20 shells (1.8×1.15 to 2.6×1.75 mm), coll. Bouchet, 1983. Senegal (coll. Marche-Marchad except where otherwise noted): Baie de Gorée 10 m, 90 specimens (1.55×0.95 to 2.15×1.4 mm); Baie de Gorée 30 m (1.4×0.9 to 1.9×1.25 mm); Baie de Gorée 33–34 m, 6 shells; Off Gorée, sta. 55–6–7A, 145–170 m, 3 shells; Baie de Gorée 25 m, S. of "Tacoma" shipwreck, 9 shells (1.50×0.95 to 2.00×1.20 mm); South of Gorée 110–112 m, 16 shells (1.4×0.9 to 2.3×1.75 mm); Dakar area 97–98 m, 30 shells (1.55×1.05 to 1.8×1.2 mm); Dakar area, 7 shells (2.15×1.35 to 2.45×1.5 mm); Dakar area 78 m, sta. 55–6–3D (14°19′N, 17°23′W), 5 shells (1.75×1.15 to 1.9×1.5 mm); SW of Cap Manuel 250 m, 1 shell (1.9×1.3 mm); Cap de Naze, in stomach of *Aluteus punctatus*, 2 specimens (2.25×1.45 to 2.35×1.45 mm); Off Saloum, sta. 55–3–9B, 80 shells (1.4×0.9 to 1.85×1.25); Off Saloum, 40 shells (1.5×0.95 to 2.4×1.4 mm); Saloum, mangroves, sta. 8, 25 specimens (2.0×1.0 to 2.75×1.7 mm), coll. Bouchet, 1973. Gabon: Conga, Bay of Corisco, 32 shells (1.4×0.95 to 2.15×1.2 mm). Congo: Pointe Noire (Plage Mondaine), 4 shells, coll. von Cosel, 1985. Angola (coll. Gofas): Ambrizete lighthouse, 25 shells; S. of Ambrizete, Bango, 90 shells; Barra do Dande, 13 shells (1.25×0.85 to 1.6×0.95 mm); Praia São Tiago, 3 shells; Cacuaco intertidal; 3 specimens and 13 shells; Cacuaco 5–10 m, 2 specimens and 3 shells; Etambar, rocks near beach, 18 specimens and 20 shells; Corimba, 20 m on bioclastic gravel, 5 specimens and 400 shells (1.25×0.9 to 2.05×1.3 mm; living animal observed and drawn); Bay of Mussulo km 17, on algae at low tide, 120 specimens (1.45×1.05 to 1.95×1.35 mm); Bay of Mussulo km 31, 15 specimens (living animal observed and drawn); Off Mussulo 90 m, 16 shells (subfossil). Off Mussulo 120 m, 50 shells (subfossil); Cape Palmeirinhas (Buraco) on rocks 2 m, 2 specimens (living animal observed and drawn); Santo Antonio near Benguela 4

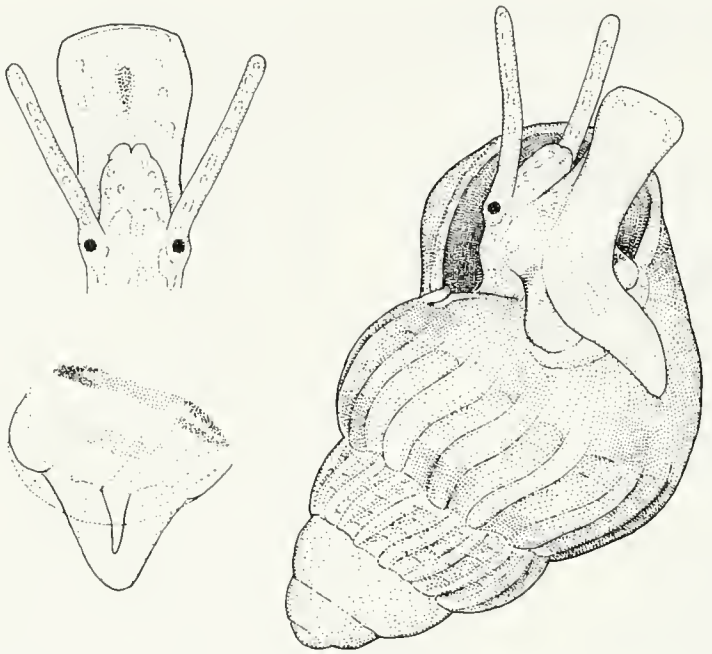


Figure 1. *Pusillina inconspicua* (Alder, 1844). Living animal from off Corimba (Angola), shell length 1.7 mm.

shells; Lucira (Sta Marta) 40 m, 1 shell; Lucira (Bissonga) on gravel of coralline algae, 2 shells; Chapéu Armado, 1 specimen and 3 shells (living animal observed and drawn); São Nicolau, 5 shells; Praia Amelia, intertidal, 1 shell.

Habitat: Most common on subtidal bioclastic coarse sands or gravels, in 10–60 m depth. Also on littoral algae from shore to sublittoral sites, and on deeper muddy bottoms on the continental shelf.

Distribution: From northern Norway to Angola, and the Mediterranean. Unverified record from the Azores (Nordsieck, 1972).

Remarks: This species is characterized by a multispiral protoconch (see Warén, 1996: 1042) with a small protoconch 1 of less than 1 whorl, and a protoconch 2 of slightly more than 2 whorls, suggesting that a long planktotrophic stage is present. Nevertheless, the protoconch/teleoconch transition is usually extremely difficult to detect, even under scanning electron microscopy. It is indicated by a change over less than 1/4 of a whorl, from the extremely sinuous growth lines that correspond to the notches that accommodate the velar lobes of the larva, to nearly axial growth lines formed after the velum is lost.

The range of bathymetric, geographic and morphological variation among West African *Pusillina* suggests that more than 1 species may be present. Individuals vary in shell morphology and color pattern (ribs strong to fine to nearly absent; apex tinged or not with purple, subopercular bar orange or yellow, yellow spots extending or not onto the tentacles and foot). The habitat range is also too broad for what is usual in a single species: in algal wash in the lagoon of Bay of Mussulo, but also on muddy bottoms on the outer part of the continental shelf. Nevertheless, there are no stable combinations of characters and thus no convincing grounds for recognition of more than 1 species at any particular site. Members of the population found in lagoonal environments of Mussulo have multispiral protoconchs and do not differ in this respect from open sea populations. Thus, there is no differentiation comparable to that of the European *Pusillina lincolata* (Michaud, 1832) and *P. inconspicua,* the former clearly separated from the latter by 1 less protoconch whorl.

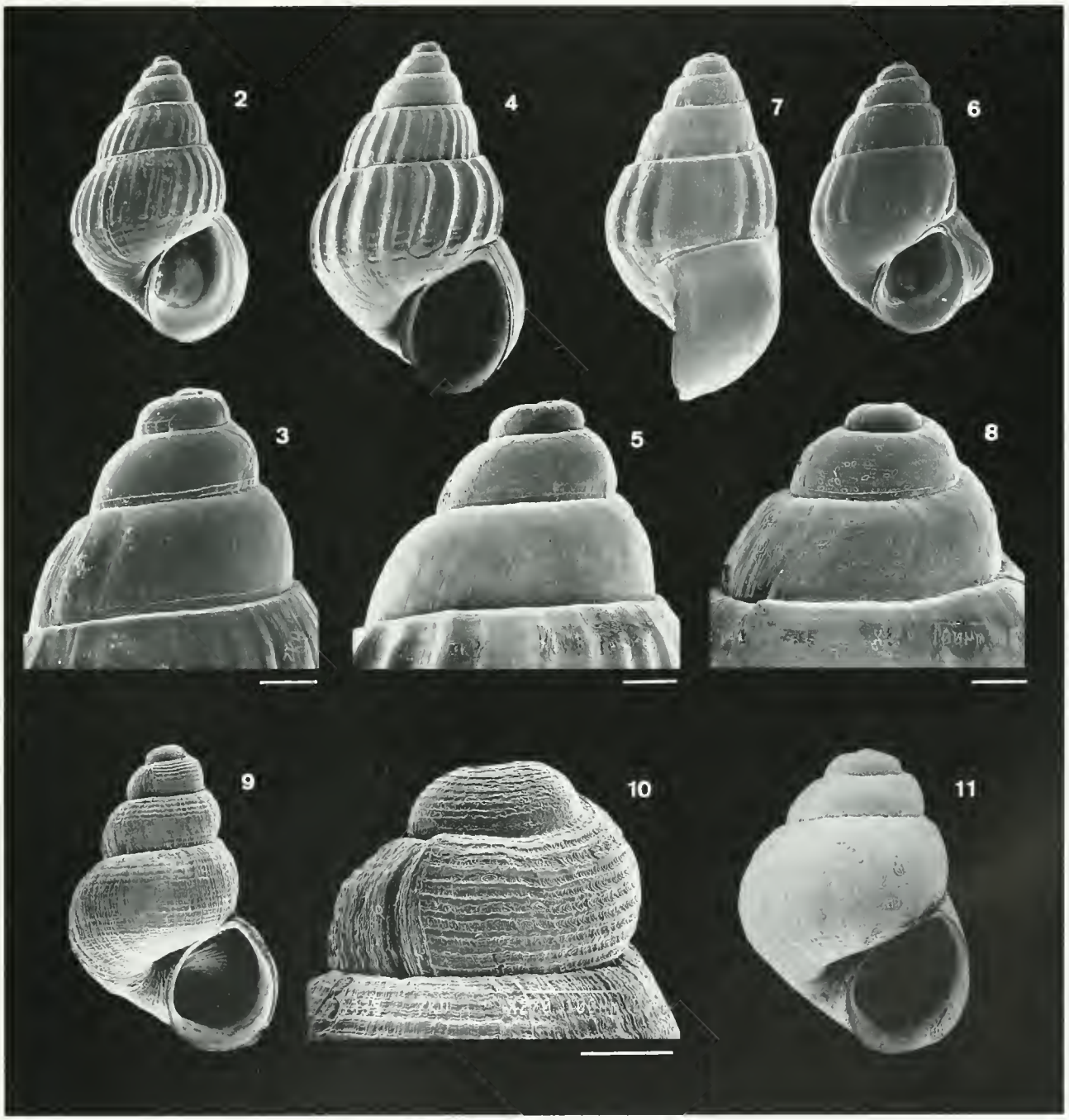
Genus *Setia* H. and A. Adams, 1852

Type species: *Rissoa pulcherrima* Jeffreys, 1848, subsequent designation by Kobelt (1878).

Setia nomca Moolenbeek and Piersma, 1990
(Figures 9–10)

Setia nomca Moolenbeek and Piersma, 1990: 31–33, figs. 1–4.

Description: Shell conical, adults 1.25×0.85 to 1.55×0.95 mm. Protoconch of 1.3 to 1.5 whorls, regularly convex, with 9–10 strong spiral cords. Teleoconch of 2.5 whorls; spire whorls very convex, regularly increasing in size, sculptured with faint, uneven spiral cords (9–12 on penultimate whorl); body whorl rounded with spiral lines continued all over. Aperture rounded, continuous; Outer lip orthocline, smooth inner surface, hardly thickened externally. Inner lip thin, bordering a narrow umbilicus. Shell color buff, with 2 interrupted, very slightly darker bands running along adapical and ab-



Figures 2–8. *Pusillina inconspicua* (Alder, 1844). **2.** Specimen from Sagres (Portugal), shell length 1.65 mm. **3.** Protoconch of the same specimen. Scale bar = 100 μm. **4.** Specimen from off Saloum (Senegal), shell length 2.1 mm. **5.** Protoconch of the same specimen. Scale bar = 100 μm. **6–7.** Specimens from Bay of Mussulo (Angola), shell lengths 1.6 and 2.1 mm. **8.** Protoconch of the specimen in fig. 7. Scale bar = 100 μm.
Figures 9–10. *Setia nomea* Moolenbeek and Piersma, 1990. **9.** Specimen from Baie de l'Etoile (Mauritanie), shell length 1.3 mm. **10.** Protoconch of another specimen from the same locality. Scale bar = 100 μm.
Figure 11. *Obtusella intersecta* (Wood, 1857). Specimen from off Ilha de Luanda (Angola), shell length 0.9 mm.

apical 1/3 of the spire whorls, and a third band on periumbilical area of body whorl.

Type material (not seen): Holotype ZMA Moll. n° 3.89.018 and 68 paratypes from type locality.

Type locality: Serini (Mauritania, 19°34′N, 16°25′W), low tide level.

Material examined: Mauritania: Baie de l'Etoile, in

tertidal, ca. 400 specimens (1.15×0.85 to 1.55×0.95 mm), coll. P. Bouchet 1983.

Habitat: On large tidal flats.

Distribution: This species is known only from a small stretch of the Mauritania coast.

Remarks: The generic allocation is not fully supported but the species is herein treated in its original binominal combination until characters of soft parts are made available. The general shape of the shell, presence of spiral sculpture, and intertidal habitat are typical of *Rudolphosetia* Monterosato, 1917 (type species *Truncatella fusca* Philippi, 1836; subsequent designation by Kobelt, 1878), a taxon which Ponder (1985) placed in the synonymy of *Setia*. Protoconch sculpture with strong spiral cords is a character shared with other species currently placed in *Alvania* (e.g., *Alvania parvula* Jeffreys, illustrated in Gofas and Warén, 1982; *Alvania watsoni* (Watson), Ponder, 1985, p. 151 fig. 102D); *Setia pulcherrima* does have spiral microsculpture on the protoconch, but one of very fine threads that look separated from the surface (Ponder, 1985, p. 134 fig. 85G; Gofas, 1990, fig. 33). The teleoconch sculpture is also shared with some species of *Alvania* (e.g., *A. parvula*, *A. punctura*) and not with *Setia pulcherrima*, which shows only growth lines.

Genus *Alvania* Risso, 1826

Type species: *Alvania europaea* Risso, 1826, subsequent designation by Nevill, 1885.

Alvania africana new species
(Figures 12–19)

Description: Shell high conical, slightly cyrtoconoid, solid, adults 1.9×0.95 mm to 3.0×1.6 mm. Protoconch of 2.2 to 2.3 convex whorls, regularly conical; surface of larval whorls (except for narrow subsutural band) with spiral lines of small granules, which merge into 3–4 continuous threads on abapical part of last larval whorl. Teleoconch of 2.3 to 4.3 whorls; spire whorls convex, with strong, widely spaced axial folds (ca. 15–25 on penultimate whorl) superimposed by strong spiral cords; 2 cords on first teleoconch whorl, 5 (rarely 4) on penultimate whorl; increasing in strength from subsutural cord to abapical one, this latter overhanging adjacent suture. Body whorl rounded, slightly constricted, with 9–10 spiral cords and axial folds gradually fading toward periumbilical area. Outer lip opisthocline, externally thickened by very strong rim strongly differentiated from adjacent external shell surface, then thinning out into delicate edge; superimposed by spiral cords that continue onto edge of lip; internally with 7–8 strong denticles. Inner lip slightly thickened, appressed on imperforate columella.

Shell color tawny with 2 broad, blurry reddish brown bands on body whorl, one subsutural and another on abapical part of body whorl; bands better defined inside aperture where they terminate at edge of outer lip. Columella generally tinged with same reddish brown; some specimens entirely reddish brown, others pale and lacking bands.

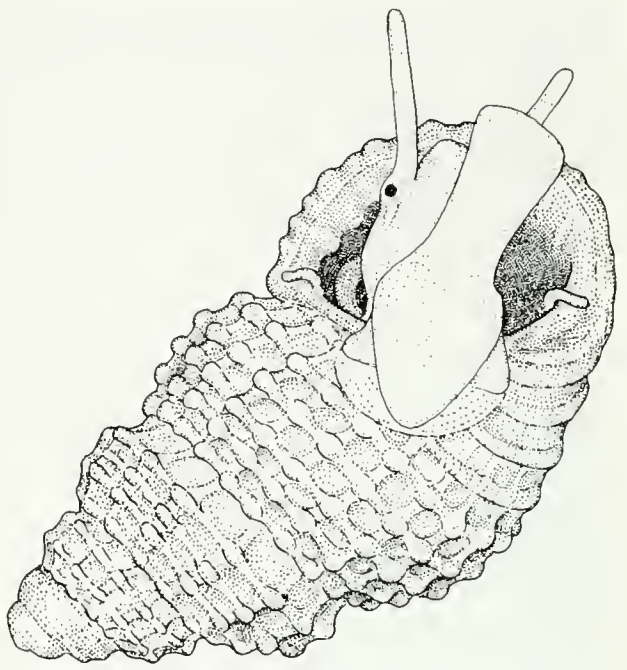


Figure 12. *Alvania africana* new species. Living animal (paratype) from off Ilha de Luanda (Angola), shell length 2.3 mm.

Head-foot colorless except for yellowish granular masses behind each eye, and faint brownish hue at tip of snout. Tentacles parallel sided, eyes in small bulge at base of each tentacle. Snout markedly bilobed, with pink buccal mass visible by transparency. Three metapodial tentacles, rather small and short, clustered tightly. Sole of foot colorless, with pedal gland inconspicuous. Right and left pallial tentacles rather conspicuous, with parallel sides, colorless.

Type material: Holotype (specimen 2.3×1.3 mm) and paratype (specimen 2.3×1.3 mm; living animal observed and drawn) from type locality (MNHN). Paratypes (9 specimens 2.3×1.2 to 2.9×1.45 mm; living animal observed and drawn) from off Ilha de Luanda, 40–60 m (MNHN). Paratypes (2 specimens 2.35×1.25 to 2.7×1.45 mm and 10 shells 1.9×1 to 2.7×1.4 mm) from off Mussulo, 90–100 m (AMS). Paratypes (2 specimens 2.4×1.3 to 2.45×2.6 mm and 10 shells 2.0×1.2 to 2.75×1.45 mm) from off Mussulo, 90–100 m (UAN).

Type locality: Off Ilha de Luanda, Angola, shell gravel, 75–80 m.

Material examined: Mauritania (coll. Richer de Forges): "Ndiago" sta. 317 (19°12′N, 16°40′W), 47 m, 1 shell (apex broken); "N'Diago" sta. 321 (19°18′N, 16°47′W), 40 m, 1 shell. Senegal (coll. Marche-Marchad): Off Saloum, 50 m, 4 shells (2.35×1.2 to 3.15×1.5 mm); Baie de Gorée, 1 shell (1.9×0.95 mm); Off Gorée

50 m, sta. 55–7–5A, 1 shell (2.35×1.25); Off Gorée 95 m,1 shell (2.1×1.05 mm). Cape Verde Islands: Porto Inglés, Maio island, "Sylvana" sta 136, 1 shell (listed as *A. cancellata* by Lamy, 1923). Angola (coll. Gofas): Type material and off Ambrizete 45 m, 40 shells, (1.9×0.95 to 2.75×1.4 mm); Off Ambrizete 80 m, 60 shells (2.05×0.95 to 2.7×1.25 mm); Off Ilha de Luanda 40–60 m, 50 shells (2.2×1.2 to 2.9×1.45 mm); Corimba 10–20 m, 5 specimens (2.75×1.5 to 3.0×1.6 mm); Off Mussulo 90–100 m, from fishermen, 3 specimens and 50 shells (2.35×1.25 to 2.75×1.45 mm); Cabo Ledo 40 m, 1 specimen (2.85×1.45 mm); Santa Maria 8–10 m, 1 specimen (3.0×1.5 mm); Bay of Lucira (Cesar) 10 m in maerl, 5 shells (2.35×1.25 to 2.95×1.55 mm); Santa Marta 40 m, 6 shells (2.35×1.2 to 3.0×1.55 mm); Praia Amélia 40–60 m, 200 shells (2.15×1.2 to 2.65×1.45 mm); Porto Alexandre, 2 specimens (2.25×1.3 mm; living animal observed and drawn).

Habitat: On hard bottoms of rocks, coarse shell gravel or (in Santa Maria and Lucira, Province of Benguela, Angola), concretions of calcareous algae, 10–60 m.

Distribution: Mauritania and Senegal; northern and southern Angola. The record from Cape Verde Islands needs confirmation.

Remarks: This species mostly resembles the European species *Alvania beani* (Hanley, 1844), having same general outline, type of teleoconch sculpture, multispiral protoconch, and colorless animal. The main differences are: (1) the protoconch is broader, with flatter spire angle, the spiral cords near abapical suture of last protoconch whorl are stronger, (2) teleoconch in average seems to be more slender, (3) the suprasutural cord on all spire whorls is overhangs the suture more conspicuously (juveniles look somewhat carinate), and (4) adults are smaller. The 2 species are not sympatric, but *A. beani* is present with a apparently consistent range of variation from the British isles to southern Morocco, then separated by ca. 1000 km from the known West African range of *A. africana.*

Alvania marioi new species
(Figures 20–24)

Description: Shell high conical, solid, adults 1.9×1.2 mm to 3.15×1.9 mm. Protoconch of 2.2 to 2.5 convex whorls, regularly conical; surface of larval whorls (except a narrow subsutural band) with spiral lines of small granules, which merge into 3–4 quite continuous threads on abapical part of last larval whorl; latter sometimes broken into slightly oblique segments arranged along spiral line. Teleoconch of 2.7 to 3.9 whorls; spire whorls convex, with strong, widely spaced axial folds (ca. 16–20 on penultimate whorl) and strong spiral cords; intersections spinose; 2 cords on first teleoconch whorl, 3 cords of equal size on penultimate whorl; adapical cord at some distance from suture forming shouldered whorl. Body whorl rounded, with 9–10 strong spiral cords and axial folds gradually fading toward periumbilical area where they are only expressed as beads on spiral cords. Outer lip slightly opisthocline, externally thickened by strong rim strongly differentiated from adjacent external shell surface, then thinning out into delicate edge; superimposed by spiral cords that continue without fading onto edge of lip; internally with 6–7 denticles. Inner lip slightly thickened, appressed on imperforate columella.

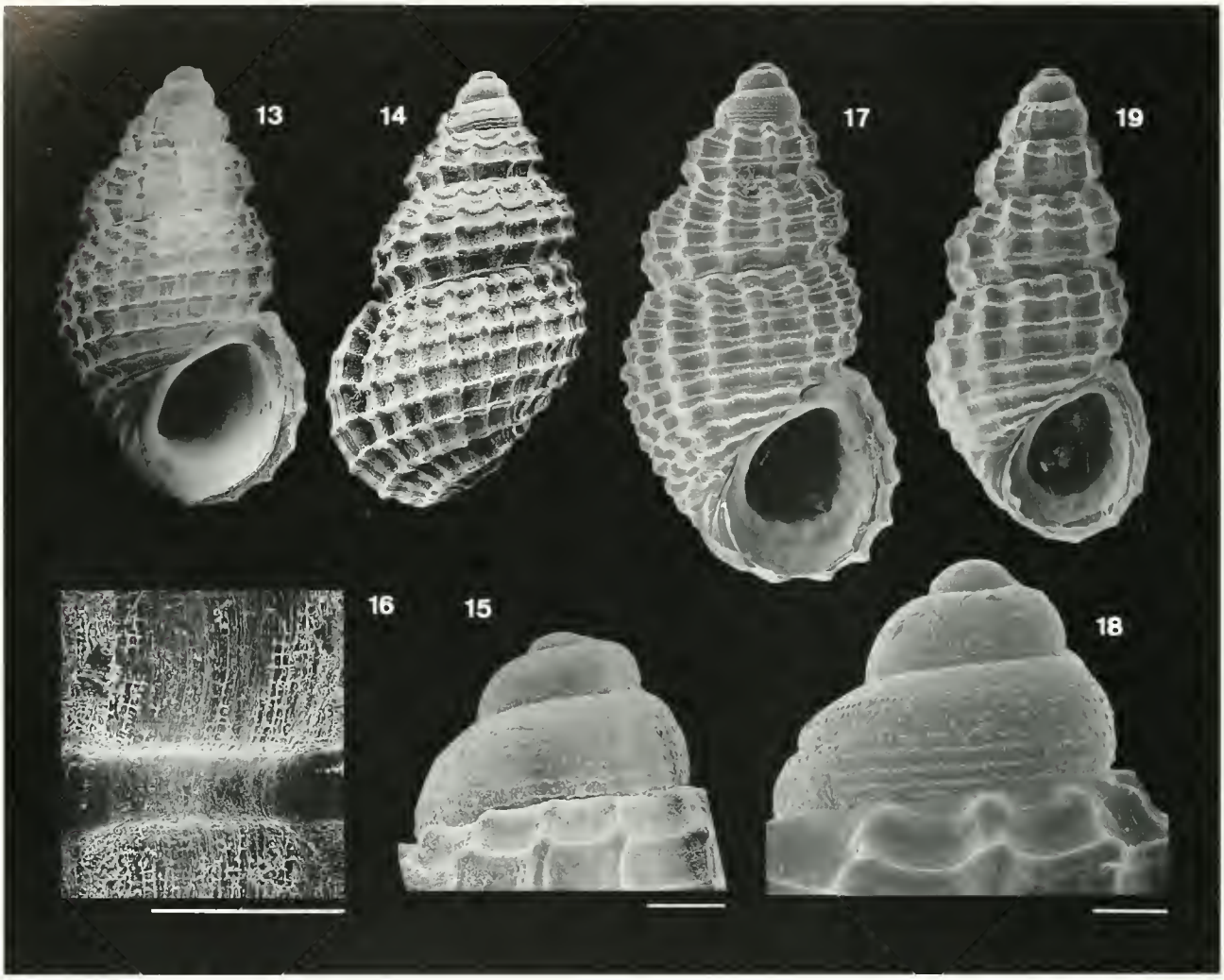
Shell color whitish, with extremely tenuous brownish tinge sometimes on body whorl adjacent to apertural rim; commonly incrusted with rusty stains on living specimens.

Head-foot colorless, with elongate opaque white granular masses behind each eye, and faint brownish hue at tip of snout. Tentacles parallel sided, slender; eyes in small bulge at base of each tentacle. Snout markedly bilobed, with pink buccal mass visible by transparency. (No notes on metapodial tentacles). Sole of foot colorless, with pedal gland inconspicuous. Right and left pallial tentacles rather conspicuous, with parallel sides, colorless.

Type material: Holotype (specimen 2.75×1.6 mm) and 5 paratypes (shell 2.5×1.55 to 2.8×1.65 mm) from the type locality (MNHN). Paratype (specimen 2.7×1.65 mm, living animal observed and drawn) from off Ilha de Luanda, 75–80 m (MNHN). Paratypes (10 shells 2.0×1.3 to 2.75×1.65 mm) from off Mussulo 90–100 m (AMS). Paratypes (10 shells 2.25×1.1.45 to 2.75×1.7 mm) from off Mussulo, 90–100 m (UAN).

Type locality: Off Ilha de Luanda (Angola), shell gravel, 40–60 m.

Material examined: Mauritania: "Ndiago" sta. 316 (19°12′N, 16°37′W), 34 m, 1 specimen. coll. Richer de Forges 1981. Senegal (coll. Marche-Marchad unless otherwise noted): Baie de Gorée 12 m, 3 specimens (2.5×1.5 to 2.8×1.7 mm), coll. Bouchet; SW of Madeleines 455 m, 1 shell (2.25×1.4 mm); SW of Gorée 150–250 m, 2 juvenile shells; Baie de Gorée, S. of "Tacoma" shipwreck, 25 m, 4 shells (1.6×1.1 to 2.2×1.4 mm); Baie de Gorée 30 m, 1 juvenile shell ; SW of Madeleines 50 m, 3 shells (2.4×1.4 to 2.6×1.5 mm); Off Saloum 50 m, 18 shells (2.1×1.3 to 2.55×1.5 mm). Ivory Coast: "Rafale" sta. 6 (5°01.5′N, 3°23.5′W), 70 m, 1 shell and 2 fragments. Angola (coll. Gofas unless otherwise noted): Type material and off Ambrizete 45 m, 5 shells (2.75×1.6 mm to 2.9×1.65 mm); Off Ambrizete 80 m, 15 shells (1.9×1.25 to 2.65×1.6 mm); Off Corimba 10–20 m, 10 shells (2.7×1.7 to 3.15×1.9 mm); Off Ilha de Luanda 40–60 m, 40 shells (2×1.2 to 2.8×1.6 mm); Off Ilha de Luanda 120 m, 14 shells (2.25×1.4 to 2.7×1.7 mm); Off Mussulo 90–100 m, from fishermen, 60 shells (2.25×1.4 to 2.9×1.75 mm); Santa Maria 5–10 m, 1 shell (3.25×1.85 mm); Santa Marta 40 m, 10 shells (2.6×1.6 to 2.9×1.95 mm); São Nicolau, shore, 22 shells (2.3×1.5 to 3.0×1.85 mm); Off Praia Amelia 40–60 m, 16 specimens + 85 shells (2.7×1.5 to 3.1×1.8 mm); Off Praia Amelia, dredged 15–35 m, 5 juvenile and 1 adult



Figures 13–19. *Alvania africana* new species, from Angola. **13–14.** Holotype, from off Ilha de Luanda, shell length 2.3 mm. **15.** Protoconch of the holotype. Scale bar = 100 μm. **16.** Detail on a teleoconch whorl of the holotype, showing the reticulate pattern of the periostracum. Scale bar = 100 μm. **17.** Specimen from off Corimba, shell length 2.75 mm. **18.** Protoconch of the same specimen Scale bar = 100 μm. **19.** Shell from off Ambrizete, shell length 2.3 mm

shell (2.0×1.2 mm), coll. Mission Gruvel May 1910 (Dautzenberg collection, Institut Royal des Sciences Naturelles, Bruxelles; identified by Dautzenberg as *Alvania cancellata* (da Costa, 1778)).

Habitat: On hard bottoms of rocks, coarse shell gravel or (in the province of Benguela), concretions of calcareous algae, 10–60 m; often found with *A. africana*.

Distribution: Mauritania and Senegal; Ivory Coast; northern and southern Angola.

Etymology: This species is named after Mario Albano dos Santos, a friend from Moçâmedes, who owns there a crab fishery and has hosted many of the collecting trips to Southern Angola.

Remarks: This species resembles *Alvania cancellata* (da Costa, 1778) with which it shares coarse sculpture and strong nodes on outer lip at the end of the abapical spiral cords. It is distinguished by being smaller and more slender and having a different construction of the most abapical cord (the one running next to columella) of body whorl, narrow and beaded in *A. marioi*, and only a massive concretion in *A. cancellata*.

The citation by Dautzenberg (1913) of *A. cancellata* is based on specimens of *A. marioi* (material examined at IRSN, Brussels). Nicklès (1950) figured true *A. cancellata* (presumably a specimen of European origin) but included the species in his guide on the basis of "being found in Angola" (i.e., based on the record by Dautzenberg, 1913, as no further data on Angola were available in 1950).

Alvania venus (d'Orbigny, 1852), a well known fossil species from the Miocene of Aquitaine Basin, SW France, resembles *A. marioi*, with which it shares the out-

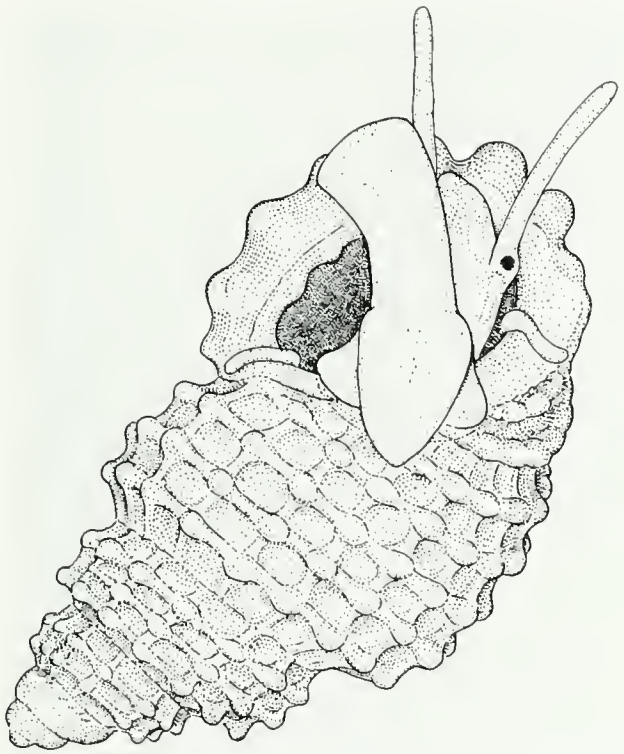


Figure 20. *Alvania marioi* new species. Living animal (paratype) from off Ilha de Luanda (Angola), shell length 2.7 mm.

line and size, the kind of sculpture and the shouldered whorls with a cord at some distance from the suture. It is nevertheless distinguished by having a third cord appearing on early teleoconch whorls.

This species may be confused with the Mediterranean *A. hispidula* Monterosato, 1884 (figures 25–26), with which it shares similar proportions, pattern of reticulation, and protoconch. One of the consistent differences resides in the architecture of the subsutural area, shouldered in *A. marioi*, with a strong cord at some distance from the suture; sloping, with a small subsutural cord in *A. hispidula*. The abapical part of the body whorl is also produced differently: 2 sharp, neatly beaded cords separated by a deep depression and terminating with marked indentations on the outer lip and then a simple cord along the umbilical chink in *A. marioi*; in *A. hispidula* the 2 cords are more roughly, irregularly beaded, not so sharp, and weakly marked over the outer lip; the last small cords along the umbilical chink tend to be duplicated. The relationships of *A. hispidula* to coarse forms ("*A. calathus* Forbes and Hanley") of the *A. beani* complex have yet to be documented. *Alvania hirta* (Monterosato, 1884), a species with a restricted distribution in the southeastern part of the Western Mediterranean, resembles this species in the architecture of the subsutural area, and in size and proportions. It differs in having a paucispiral protoconch and only 2 cords on the penultimate whorl.

Alvania flexilis new species
(Figures 27–32)

Description: Shell high conical, cyrtoconoid, moderately solid, adults 1.0×0.7 mm to 2.0×1.2 mm. Protoconch of 2 to 2.2 convex whorls, first one slightly depressed; surface of larval whorls (except for narrow subsutural band) with spiral lines made of closely set or contiguous small granules. Teleoconch of 2 to 3 whorls, with sculpture of thin, sharp, widely spaced spiral cords superimposed on thin, sinuous axial ribs. Spire whorls have 1 cord running along adapical suture, second cord quite close to subsutural one, and suprasutural cord on abapical side, overhanging suture at some distance; spiral cords are poorly developed in between. One or 2 additional spiral cords gradually appear in that interval on penultimate whorl, so that there are about 10 evenly spaced spiral cords on body whorl. Axial ribs very gradually fade out on abapical part of body whorl. Ribs on body whorl 15–30. Outer lip opisthocline, with thin edge and thickened externally at distance of edge by broad rim, superimposed by spiral cords; smooth and not thickened internally. Inner lip thin, bordering tiny umbilical chink.

Shell color tawny with 2 very faint brownish bands, one over the 2 subsutural cords, other approximately at anterior 1/3 of body whorl, ending in a more intense blotch near edge of aperture.

Type material: Holotype (shell 1.6×1.05 mm) and 5 paratypes (shells 1.45×0.95 to 1.85×1.1 mm) from type locality (MNHN). Paratypes (10 shells 1.2×0.75 to 1.9×1.15 mm) from off Mussulo, 90–100 m (AMS). Paratypes (10 shells 1.25×0.8 to 1.95×1.15 mm) from off Mussulo, 90–100 m (UAN).

Type locality: Off Ilha de Luanda (Angola), shell gravel, 40–60 m.

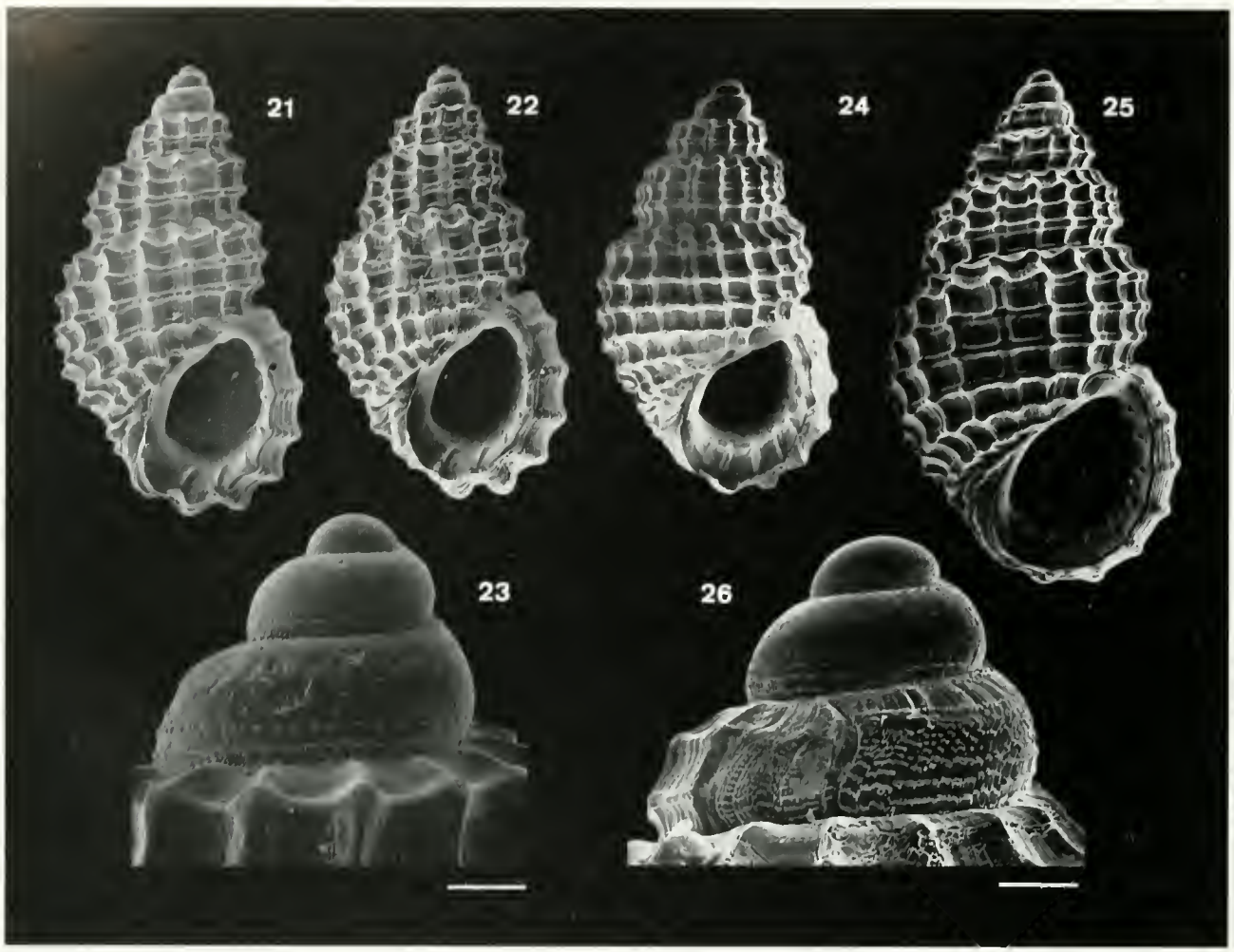
Material examined: Senegal (coll. Marche-Marchad): Off Saloum 50 m, 9 shells (1.05×0.7 to 1.5×0.9 mm); Dakar area 97–98 m, 1 shell (1.6×1 mm). Equatorial Guinea: (1°40′N, 9°25′E), 150 m, 1 shell (1.3×0.8 mm). Angola (coll. Gofas): Type material and off Ambrizete 45 m, 18 shells (1.05×0.7 to 1.35×0.9 mm); Off Ambrizete 80 m, 38 shells (1.05×0.75 to 1.75×1 mm); Off Ilha de Luanda 40–60 m, 20 shells (0.95×0.7 to 1.85×1.1 mm); Off Ilha de Luanda120 m, 40 shells (1.55×0.9 to1.05×0.65 mm); Off Mussulo 90–100 m, 80 shells (1.1×0.75 to 2.0×1.2 mm) ; Praia Amelia 40–60 m, 4 shells (1.4×0.9 to 1.6×1.0 mm); Off Ponta Albina 40 m, 1 shell (1.2×0.75 mm).

Habitat: On muddy bottoms of outer shelf.

Distribution: Mauritania and Senegal; Gulf of Guinea; Northern and Southern Angola.

Etymology: The specific name alludes to the shell sculpture with sinuous axial ribs.

Remarks: This species somewhat resembles the European species *Alvania testae* (Aradas and Maggior



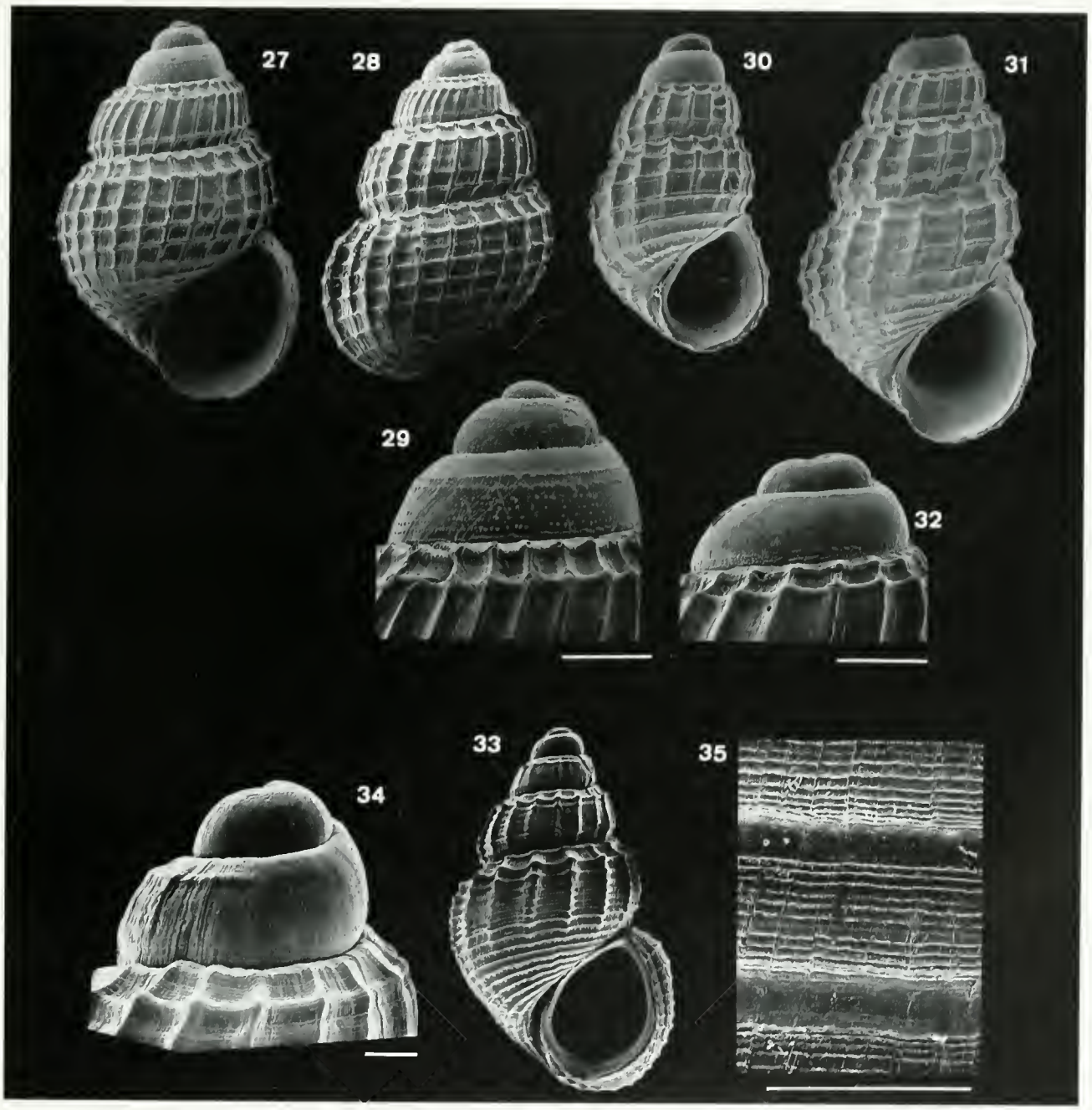
Figures 21–24. *Alvania marioi* new species. **21.** Shell from off Ambrizete (Angola), shell length 2.9 mm. **22.** Holotype, from off Ilha de Luanda (Angola), shell length 2.75 mm. **23.** Protoconch of the holotype Scale bar = 100 μm. **24.** Specimen from off Saloum (Senegal), shell length 2.5 mm.
Figures 25–26. *Alvania hispidula* Monterosato, 1884 **25.** Specimen from off San Vito (Sicily), coll. Monterosato, shell length 3.25 mm. **26.** Protoconch of the same specimen Scale bar = 100 μm.

1844) because of its sinuous ribs and very opisthocline outer lip. It also occupies a similar habitat on muddy offshore bottoms. It differs in having (1) thinner and smaller shell, and (2) larger protoconch that forms a more obtuse apical angle, lacking oblique threads on adapical part of the whorls (see Bouchet and Warén, 1993: fig. 1387, for an illustration of the protoconch of *A. testae*).

The Miocene fossil species *Alvania raulini* Cossmann and Peyrot, 1918, from the Aquitaine Basin, is very similar is size, general outline, and habitat on the muddy outer shelf. It shares with *A. flexilis* the teleoconch sculpture with 2 stronger spiral cords, respectively adapically and abapically from the suture. The protoconch is nevertheless much smaller, with 1 less whorl.

Alvania regina new species
(Figures 33–35)

Description: Shell high conical, solid, adults 2.05×1.35 mm to 2.7×1.6 mm. Protoconch with 1.4–1.5 convex whorls, globose; whorls apparently smooth, with minute and scarce granules visible only under high magnification (scanning electron microscopy). Teleoconch with 2.9–3.2 whorls; spire whorls convex, with sinuous axial folds (ca. 18–22 on penultimate whorl) and spiral cords much narrower than interspaces; intersections blunt; most cords indistinct on first teleoconch whorl, except for 1 subsutural and 1 suprasutural which will remain stronger throughout subsequent whorls; adapical one quite separated from suture. Penultimate whorl with 6–7 spiral cords. Body whorl rounded, with 16–18 spiral cords and folds gradually fading towards periumbilical area; subsutural cord stronger, others equal in size. Fine microsculpture of spiral threads on teleoconch whorls. Outer lip slightly opisthocline, externally thickened by strong rim that is strongly differentiated from adjacent external shell surface; superimposed by spiral cords which continue, very attenuated, on its outer surface; inner surface smooth. Inner lip



Figures 27–32. *Alvania flexilis* new species, from Angola. **27–28.** Shell (holotype) from off Ilha de Luanda, shell length 1.6 mm. **29.** Protoconch of the holotype. Scale bar = 100 μm. **30–31.** Shells from off Ambrizete, shell length 1.3 and 1.8 mm. **32.** Protoconch of the specimen fig. 31. Scale bar = 100 μm.
Figures 33–35. *Alvania regina* new species, from Senegal. **33.** Shell (holotype) from off SW of Cap Manuel, 250 m, shell length 2.7 mm. **34.** Protoconch of the holotype. Scale bar = 100 μm. **35.** Detail of the microsculpture on a teleoconch whorl of the holotype. Scale bar = 100 μm.

slightly thickened, leaving a distinct umbilical chink. Shell white.

Type material: Holotype (shell 2.7×1.6 mm) and 5 paratypes (shells 2.05×1.35 to 2.45×1.55 mm) from type locality, coll. Marche-Marchad (MNHN).

Type locality: SW of Cap Manuel (Senegal), 250 m.

Habitat: On muddy bottoms of upper slope.

Distribution: Known only from type locality.

Etymology: The specific name alludes to the pattern of subsutural knobs, which resemble a queen's crown.

Remarks: This species shares with *A. flexilis* the sculp

ture of sinuous, sharp axial ribs, spiral cords that become stronger abapically from suture, and outer lip smooth internally. It is clearly differentiated by its larger size, outer lip thickened externally, spiral microsculpture, and protoconch with 1 less whorl. It does not resemble any of the known Western European species.

Alvania gofasi (Rolán and Fernandes, 1990)
(Figures 36–39)

Manzonia gofasi Rolán and Fernandes, 1990, p. 63–64, pl. 1, figs. 1–3.

Description: Shell high conical, solid, adults 1.5×1 mm to 2.1×1.3 mm. Protoconch with 2 convex whorls, first one slightly flattened on top; surface of larval whorls with pair of spiral lines, formed by slightly oblique segments, at some distance from adapical suture, and cluster of other 2–3 such lines near abapical suture. Teleoconch with 2.2–2.8 whorls; spire whorls very convex, with strong, widely spaced axial folds (ca. 12–14 on penultimate whorl) and strong spiral cords; intersections pointed; 3 cords on all spire whorls; adapical cord situated at some distance from suture forming shoulder. Spiral microsculpture of fine striae (ca. 40 between a pair of cords) visible under SEM, evenly set on cords and interspaces, and superimposed on axial folds. Body whorl rounded, with 6 strong spiral cords and faint seventh cord just bordering umbilical chink; axial folds gradually fading toward periumbilical area; fifth cord separated from sixth one by slightly broader and deeper interspace, sixth cord smooth. Outer lip very slightly opisthocline, externally thickened by very strong rim that is strongly differentiated from adjacent external shell surface, terminating with clearly differentiated flat surface on apertural plane; superimposed externally by spiral cords that terminate abruptly at edge of that surface; inner surface of aperture smooth, clearly differentiated from apertural edge. Inner lip slightly thickened, narrowing towards small umbilical chink.

Shell color whitish, with pale brownish band on middle part of spire whorls and another one on periumbilical area, not continued on aperture.

Type material: Holotype (not seen) in MNCN, Madrid.

Type locality: Off Ilha de Luanda (Angola), 50–100 m.

Material examined: Senegal (coll. Marche-Marchad): Off Gorée 95 m, 1 specimen + 1 shell (1.8×1.2 to 2.1×1.3 mm); SW of Cap Manuel, 2 shells. Angola (coll. Gofas): Ambrizete 45 m, 7 shells (1.45×0.95 to 1.75×1.1 mm); Ambrizete 80 m, 3 shells (1.7×1.05 mm to 1.4×0.9 mm); Off Ilha de Luanda 40–60 m, 9 shells (1.5×0.95 to 2×1.2 mm); Off Ilha de Luanda 120 m, 9 shells (1.75×1.15 mm to 1.45×1 mm); Off Mussulo (Macoco) 50–70 m, 4 shells (1.75×1.15 to 1.9×1.25 mm); Off Mussulo 90–100 m, 2 specimens + 20 shells (1.6×1 mm to 2×1.25 mm).

Habitat: On rocky areas of the outer shelf.

Distribution: Only known from Senegal and from Northern Angola.

Remarks: This species is very similar to the European *A. zetlandica* (Montagu, 1815) and shares with it the sculpture, microsculpture, and the peculiar construction of the aperture with a flat, beveled edge. This latter structure is not present in any other European of West African rissoid and seems unique. I agree with Moolenbeek and Faber (1987) that this species should not be allocated to the genus *Manzonia* Brusina, 1870 (type species by original designation: *Turbo costatus* Adams, 1797 = *T. crassus* Kanmacher, 1798), and that *Manzonia* should include only species having pitted spiral microsculpture.

Alvania fariai (Rolán and Fernandes, 1990)
(Figures 40–42)

Manzonia fariai Rolán and Fernandes, 1990: 64–65, pl. 1 figs. 4–6.

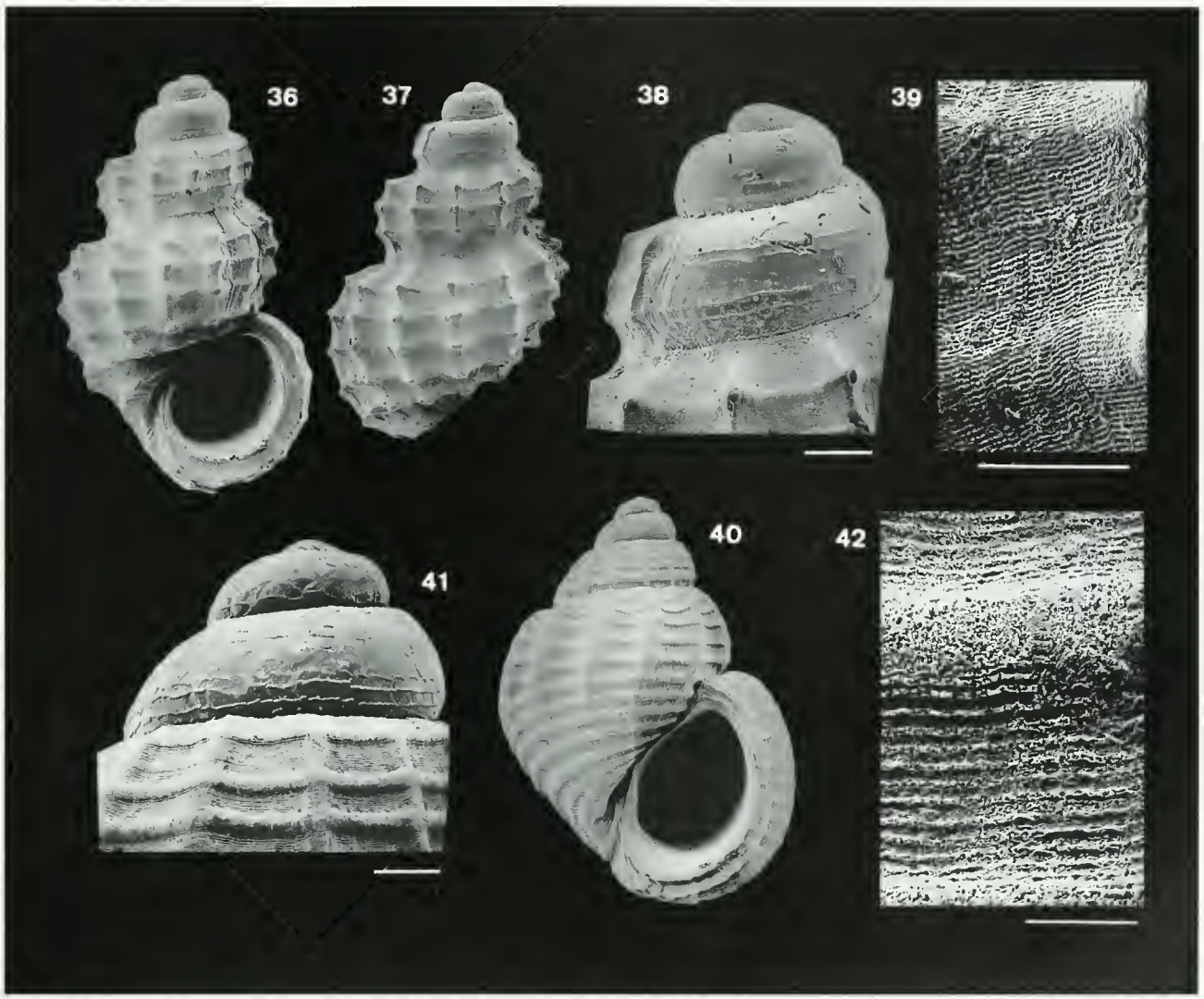
Description: Shell conical, moderately solid, adults 2.15×1.6 mm to 2.55×1.85 mm. Protoconch conical with 2–2.2 convex, laterally compressed whorls; protoconch whorls with 7–8 very fine spiral threads that tend to break into small, slightly oblique segments. Teleoconch with 2.2–2.8 whorls, with sculpture of blunt spiral cords superimposed on broad, sinuous axial ribs; 4 cords on first teleoconch whorl, 5 on penultimate, 12–13 on body whorl. Axial ribs (ca. 15–16 on body whorl) gradually fading on periumbilical area, where spiral cords are broader and flatter. Outer lip very slightly opisthocline and sinuous, thickened externally by prominent rim, raised to form sort of crest in its adapical part; superimposed by spiral cords which terminate abruptly at edge of the inner surface; most abapical spiral cords of body whorl also extending on outer lip; inner surface smooth and not thickened, clearly differentiated from outer surface of apertural rim. Inner lip rather narrow, bordering tiny umbilical chink. Shell color white.

Type material: Holotype (not seen) in MNCN, Madrid.

Type locality: Off Ilha de Luanda (Angola), 100 m.

Material examined: Senegal (coll. Marche-Marchad): SW of Cap Manuel 250 m, 12 shells (2.15×1.65 to 2.55×1.85 mm); SW of Gorée 150–250 m, 1 shell (2.25×1.65 mm). Off Gorée sta. 56-1-10A, 150–200 m, 1 shell (2.5×1.85 mm). Angola (coll. Gofas): Off Ambrizete 60 m, 1 shell + 2 fragments (2.2×1.6 mm); Off Ambrizete 80 m, 5 shells (2.2×1.65 to 2.45×1.75 mm); Off Ilha de Luanda 40–60 m, 1 shell (2.35×1.65 mm); Off Ilha de Luanda 120 m, 3 shells (2.3×1.7 to 2.35×1.7 mm); Off Mussulo (Macoco) 50–70 m, 2 shells (2.25×1.7 to 2.35×1.7 mm).

Habitat: On the outer shelf and upper slope, type of bottom unknown.



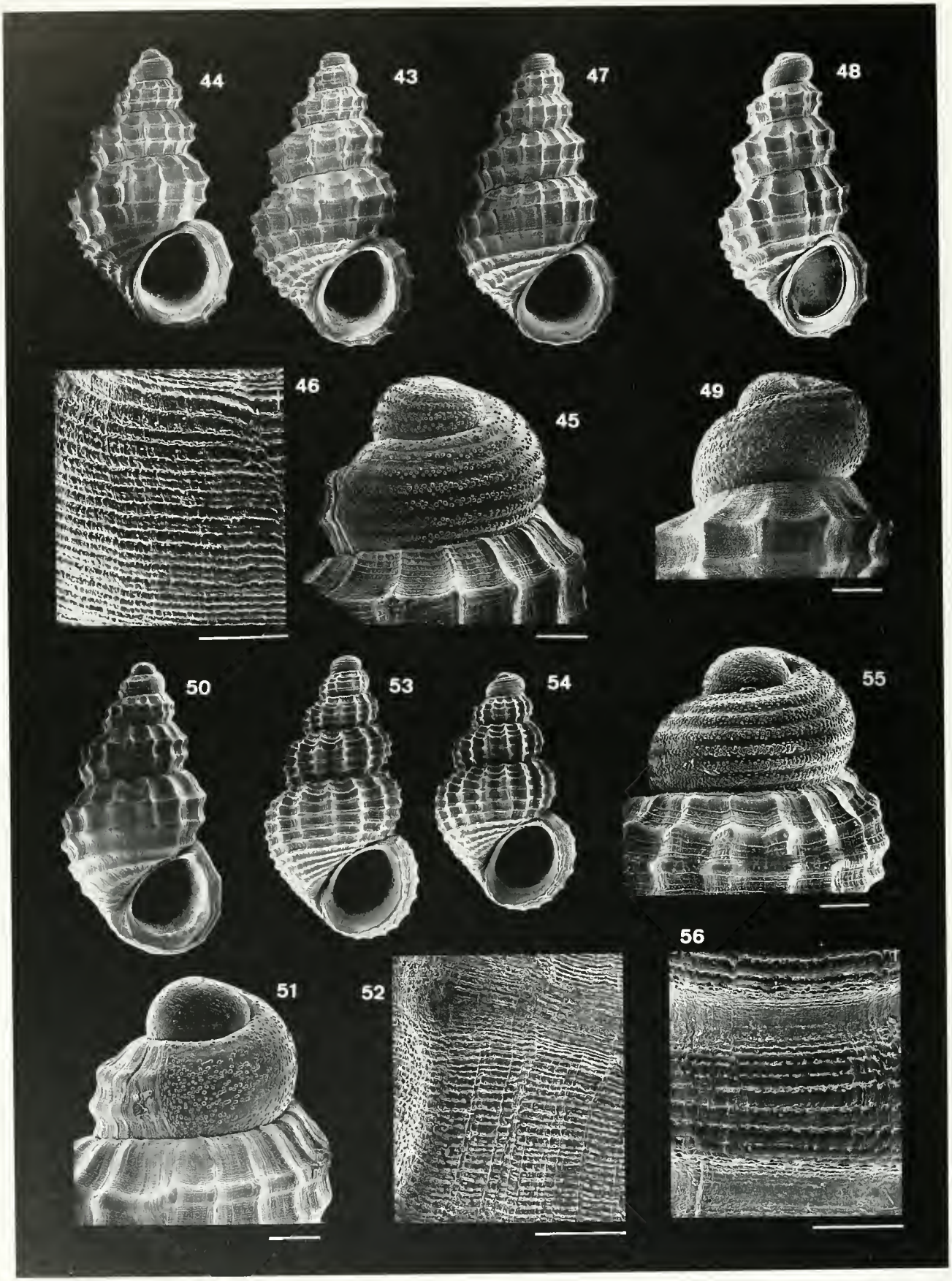
Figures 36–39. *Alvania gofasi* (Rolán and Fernandes, 1990), from Angola. **36–37.** Shells from off Ambrizete, shell length 1.7 mm and 1.55 mm. **38.** Protoconch of the specimen fig. 37. Scale bar = 100 μm. **39.** Detail of the microsculpture on a teleoconch whorl of the same specimen. Scale bar = 50 μm.
Figures 40–42. *Alvania fariai* (Rolán and Fernandes, 1990), from Angola. **40.** Shell from off Ambrizete, shell length 2.2 mm. **41.** Protoconch of the specimen fig. 40. Scale bar = 100 μm. **42.** Detail of the microsculpture on a teleoconch whorl of the same specimen. Scale bar = 20 μm.

Distribution: Senegal and northern Angola.

Remarks: This species is not closely related to any other extant species of the Rissoidae, but resembles an undescribed species from deep-water Oligocene deposits of SW France (Lozouet, pers. comm.), with which it shares the peculiar arrangement of the outer lip and the rather cylindrical protoconch whorls. It does not have the punctate spiral sculpture of *Manzonia*.

Alvania marchadi new species
(Figures 43–47)

Description: Shell high to very high conical, solid, adults 2.25×1.25 mm to 2.95×1.5 mm. Protoconch with 1.3–1.5 convex whorls, globose; with 7 spiral flat cords, as broad as interspaces, formed by minute granules that can be distinguished only under high magnification. Teleoconch with 3.3–4.2 whorls; spire whorls convex, with strong, widely spaced, nearly vertical axial folds (ca. 12–14 on penultimate whorl) and strong spiral cords, narrower than interspaces; intersections pointed; 2 cords on first and second teleoconch whorl, third one inserted between suture and most adapical of preexisting cords on second teleoconch whorl, progressively increasing in strength. Body whorl rounded, with 8 spiral cords and axial folds gradually fading towards periumbilical area; spiral cords most developed near periphery, 2 cords bordering inner lip faint and coalescent. Teleoconch whorls with fine spiral microsculpture of wrinkled threads. Out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er lip slightly opisthocline, externally thickened by very strong rim strongly differentiated from adjacent external shell surface; superimposed by spiral cords that continue, very attenuated, onto edge of lip; inner surface smooth. Inner lip slightly thickened, loosely appressed on columella. Shell color whitish.

Type material: Holotype (shell 2.7×1.4 mm) and 9 paratypes (shells 2.2×1.35 to 2.95×1.45 mm) from type locality, coll. Marche-Marchad, 20 Feb. 1956 (MNHN). Paratypes (3 shells 2.5×1.4 to 3.0×1.55 mm) from type locality (AMS).

Type locality: SW of Cap Manuel, Dakar area (Senegal), 80–250 m.

Material examined: Morocco: Off Sidi Ifni, "Cineca 3" sta. B33 (29°23′N, 10°50′W), 132 m, 34 shells (2.25×1.3 to 2.85×1.45 mm), coll. Glémarec 1972. Mauritania: "Ndiago" sta. 01 (20°18′N, 17°40′W), 185 m, 1 shell (2.5×1.5 mm), coll. Richer de Forges 1981. Senegal (coll. Marche-Marchad): Type material and Dakar area 170–200 m, 1 shell (2.5×1.5 mm); S. of Gorée 110–112 m, 12 shells (2.25×1.25 to 2.75×1.45 mm); Off Gorée 150–200 m, sta. 56-1-10A, 12 shells (2.4×1.35 to 2.9×1.5 mm); Dakar (no details) 1 specimen (2.25×1.25 mm).

Habitat: On deeper part of shelf and upper part of slope, bottom type unknown.

Distribution: From the Saharan coast to Senegal.

Etymology: The species is named after Igor Marche-Marchad, who has collected most of the Senegalese material studied herein and contributed much to the knowledge of West African mollusks.

Remarks: This species resembles the Mediterranean species *A. subareolata* (Monterosato, 1869) (figures 48–49 herein, specimen collected near the type locality). The main differences are that *A. marchadi* is larger, the spiral microsculpture is better defined, there is an additional cord on the broad shoulder of body whorl, the granules on protoconch are more clearly organized to form spiral cords, and it is whitish instead of brown or banded.

The length-width ratio is apparently surprisingly variable, even within the same population, but this is not correlated with any other character, which would suggest presence of more than 1 species.

Alvania richeri new species
(Figures 50–52)

Description: Shell high conical, solid, adults 2.1×1.2 mm to 2.7×1.55 mm. Protoconch with 1.3–1.5 convex whorls, globose; surface of larval whorls with minute granules that can be distinguished only under high magnification; some of them loosely aligned spirally or obliquely. Teleoconch with 3.3–4.0 whorls; spire whorls convex, with widely spaced, nearly vertical axial folds (ca. 15 on penultimate whorl) and spiral cords narrower than interspaces; intersections bluntly pointed; 2 cords on first and second teleoconch whorl, adapical one quite separated from suture; adapical edge of whorls along suture somewhat swollen. Body whorl rounded, with 6 spiral cords and axial folds gradually fading towards perumbilical area; spiral cords near periphery most developed, 2 bordering inner lip quite faint and coalescent. Teleoconch whorls with extremely fine spiral microsculpture of granulose threads. Outer lip slightly opisthocline, externally thickened by very strong rim strongly differentiated from adjacent external shell surface; superimposed by spiral cords that continue, very attenuated, on its outer surface; inner surface smooth. Inner lip slightly thickened, leaving a distinct umbilical chink. Shell color whitish.

Type material: Holotype (shell 2.70×1.45 mm) and 8 paratypes (shells 2.1×1.2 to 2.7×1.45 mm) from the type locality, coll. Marche-Marchad, 20 Feb. 1956. Paratypes (3 shells 2.20×1.25 to 2.7×1.4 mm) from type locality (AMS).

Type locality: SW of Cap Manuel, Dakar area (Senegal), 80–250 m.

Material examined: Mauritania: "Ndiago" sta. 243 (17°48′N, 16°32′W), 200 m, 1 shell (2.4×1.35 mm), coll. Richer de Forges 1981. Senegal: Type material and S. of Gorée 110–112 m, 3 shells (2.25×1.3 to 2.35×1.35 mm), coll. Marche-Marchad; South of Dakar (14°35′N,

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Figures 43–47. *Alvania marchadi* new species. **43.** Shell (holotype) from off SW of Cap Manuel (Senegal), shell length 2.7 mm. **44.** Shell (paratype), from the type locality, shell length 2.5 mm. **45.** Protoconch of the paratype fig. 44. Scale bar = 100 µm. **46.** Detail of the microsculpture on a teleoconch whorl of the same specimen. Scale bar = 50 µm. **47.** Shell from off Sidi Ifni (Morocco), shell length 2.7 mm.
Figures 48–49. *Alvania subareolata* (Monterosato, 1869). **48.** Specimen from off Linosa (Sicily channel), shell length 1.9 mm. **49.** Protoconch of the same specimen. Scale bar = 100 µm.
Figures 50–52. *Alvania richeri* new species. **50.** Holotype from off SW of Cap Manuel (Senegal), shell length 2.7 mm. **51.** Protoconch of the holotype. Scale bar = 100 µm. **52.** Detail of the microsculpture on a teleoconch whorl of the holotype. Scale bar = 50 µm.
Figures 53–56. *Alvania coseli* new species. **53.** Shell (holotype) from off Dakar (Senegal), shell length 2.75 mm. **54.** Paratype from the type locality, length 2.3 mm. **55.** Protoconch of the paratype fig. 54. Scale bar = 100 µm. **56.** Detail of the microsculpture on a teleoconch whorl of the same specimen. Scale bar = 50 µm.

17°35′W), 120 m, 1 shell (2.6×1.35 mm), coll. Leung Tak.

Habitat: On deeper part of shelf and upper part of slope, type of bottom unknown.

Distribution: Mauritania and Senegal.

Remarks: This species is extremely similar to and lives sympatrically with *A. marchadi*, a species with which it is easily confused. It is distinguished by absence of linear arrangement of minute granules on protoconch surface, which appears smooth under stereomicroscope. The teleoconch of *A. richeri* can be differentiated by the more distinct umbilical chink and by lack of an additional cord on shoulder of last whorls. It is also similar to *A. subarcolata*, but differs in its larger size, stouter profile with a swollen subsutural area, and blunt teleoconch sculpture.

The species is named after Bertrand Richer de Forges, marine biologist at ORSTOM (the French government's overseas research agency) and collector of most of the Mauritanian material studied here.

Alvania coscli new species
(Figures 53–56)

Type material: Holotype (shell 2.75×1.5 mm) and 7 paratypes (shells 2.3×1.4 to 2.8×1.55 mm), coll. Marche-Marchad. Paratypes (3 shells, 2.1×1.2 to 2.25×1.3 mm) from off Gorée 95 m, coll. Marche-Marchad (AMS).

Type locality: Dakar area, 95 m.

Material examined: Morocco: Off Sidi Ifni, "Cineca" sta. B33 (29°23′N, 10°50′W), 132 m, 3 shells (2.1×1.1 to 2.25×1.1 mm), coll. Glémarec 1972. Mauritania: "N'Diago" sta. 118 (18°36', 16°31′W), 96 m, 1 shell (2.35×1.3 mm); "N'Diago" sta. 119 (18°36', 16°28′W), 70 m, 4 shells (2.45×1.3 to 2.7×1.4 mm), coll. Richer de Forges 1981. Senegal (coll. Marche-Marchad): Type material and S of Gorée 110–112 m, 14 shells (2.1×1.25 to 2.6×1.4 mm); Off Gorée 50 m, 1 shell (2.2×1.3 mm); Dakar area (14°32', 17°25′W), 50 m, 1 shell (2.25×1.3 mm); Off Gorée, sta. 56–1–10A, 150–200 m, 1 shell (2.5×1.35 mm).

Description: Shell high, conical, solid, adults 2.1×1.2 mm to 2.75×1.55 mm. Protoconch with 1.3–1.5 convex whorls, globose; surface with 7 spiral flat cords, as broad as interspaces, formed by minute granules visible only under high magnification. Teleoconch with 4 whorls; spire whorls convex, with widely spaced, nearly vertical axial folds (ca. 16–18 on penultimate whorl) and spiral cords narrower than interspaces, superimposed on axial folds; 4 cords on first and second teleoconch whorl, adapical one bordering suture. Body whorl rounded, with 12–13 quite even spiral cords and axial folds gradually fading toward periumbilical area. Teleoconch whorls with extremely fine spiral microsculpture of widely spaced granulose threads. Outer lip slightly opisthocline, externally thickened by very strong rim strongly differentiated from adjacent external shell surface; superimposed by spiral cords, which continue, very attenuated, on its outer surface; inner surface smooth. Inner lip slightly thickened, leaving distinct umbilical chink. Shell white.

Habitat: On deeper part of shelf and upper part of slope, type of bottom unknown, often found together with *A. marchadi* and *A. richeri*.

Distribution: From the coast of Sahara to Senegal.

Etymology: The species is named after Rudo von Cosel, as a tribute to his contributions to West African malacology.

Remarks: This species shares with *A. subarcolata*, *A. marchadi*, and *A. richeri* the general outline, vertical axial ribs, teleoconch microsculpture and the very peculiar microsculpture of closely arranged granules on the protoconch. Based on these shell characters, these species are provisionally considered to belong to a monophyletic group. *Alvania coscli* is distinguished from these species by having about twice as many spiral cords.

Genus *Crisilla* Monterosato, 1917

Type species: *Turbo semistriatus* Montagu, 1808, by monotypy.

Crisilla transitoria new species
(Figures 57–61)

Description: Shell conical, slightly cyrtoconoid, moderately solid, adults 1.40×0.85 mm to 2.25×1.35 mm. Protoconch with 2.3–2.7 whorls, first one depressed, giving spire slightly cyrtoconoid profile; with spiral lines of tiny granules, well-defined on first whorl, becoming loosely arranged on second whorl, again well-defined on last larval whorl. Teleoconch with 2.2–3.0 whorls; spire whorls slightly convex, with moderately developed, tightly arranged axial folds (ca. 35 on penultimate whorl) and spiral cords; 2 subsutural and suprasutural cords stronger; remaining (2 on first teleoconch whorl, 5 on penultimate) weak and not superimposed on axial folds. Body whorl rounded, slightly constricted, with 18–20 spiral cords and axial folds gradually fading toward periumbilical area. Outer lip orthocline, smooth inner surface, slightly thickened externally at some distance from sharp edge. Inner lip thin, bordering tiny umbilical chink. Shell color buff, with 1 row of large, square subsutural brown patches; 1 row of smaller suprasutural brown patches, which continues on body whorl, and spiral rows of smaller patches on periumbilical area.

Head-foot semitransparent, whitish with triangular, opaque yellow patches behind eyes, and interrupted yellow bars on tentacles. Foot with distinct anterior pedal gland and cluster of 3 small metapodial tentacles; 2 small, colorless pallial tentacles.

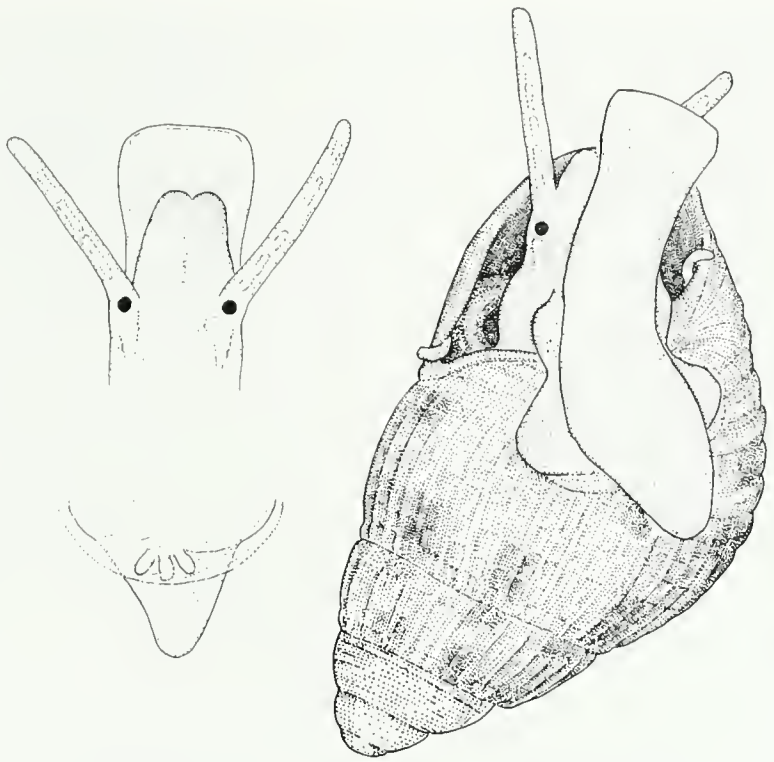


Figure 57. *Crisilla transitoria* new species. Living animal (paratype) from Palmeirinhas (Angola), shell length 1.8 mm.

Type material: Holotype (specimen 1.8×1.1 mm) and 5 paratypes (specimen 1.65×1.1 to 2.1×1.3 mm) from type locality (MNHN). Paratypes (6 specimens, 1.7×1.05 to 1.8×1.1 mm; living animal observed and drawn) from Palmeirinhas, Buraco, rocks in 2–3 m. Paratypes (5 specimens 1.65×1.1 to 1.9×1.2 mm) from type locality (AMS). Paratypes (5 specimens 1.65×1.05 to 1.95×1.2 mm) from type locality (UAN).

Type locality: Corimba, province of Luanda (Angola, 8°50′S, 13°09′E), on shell gravel, 10–20 m.

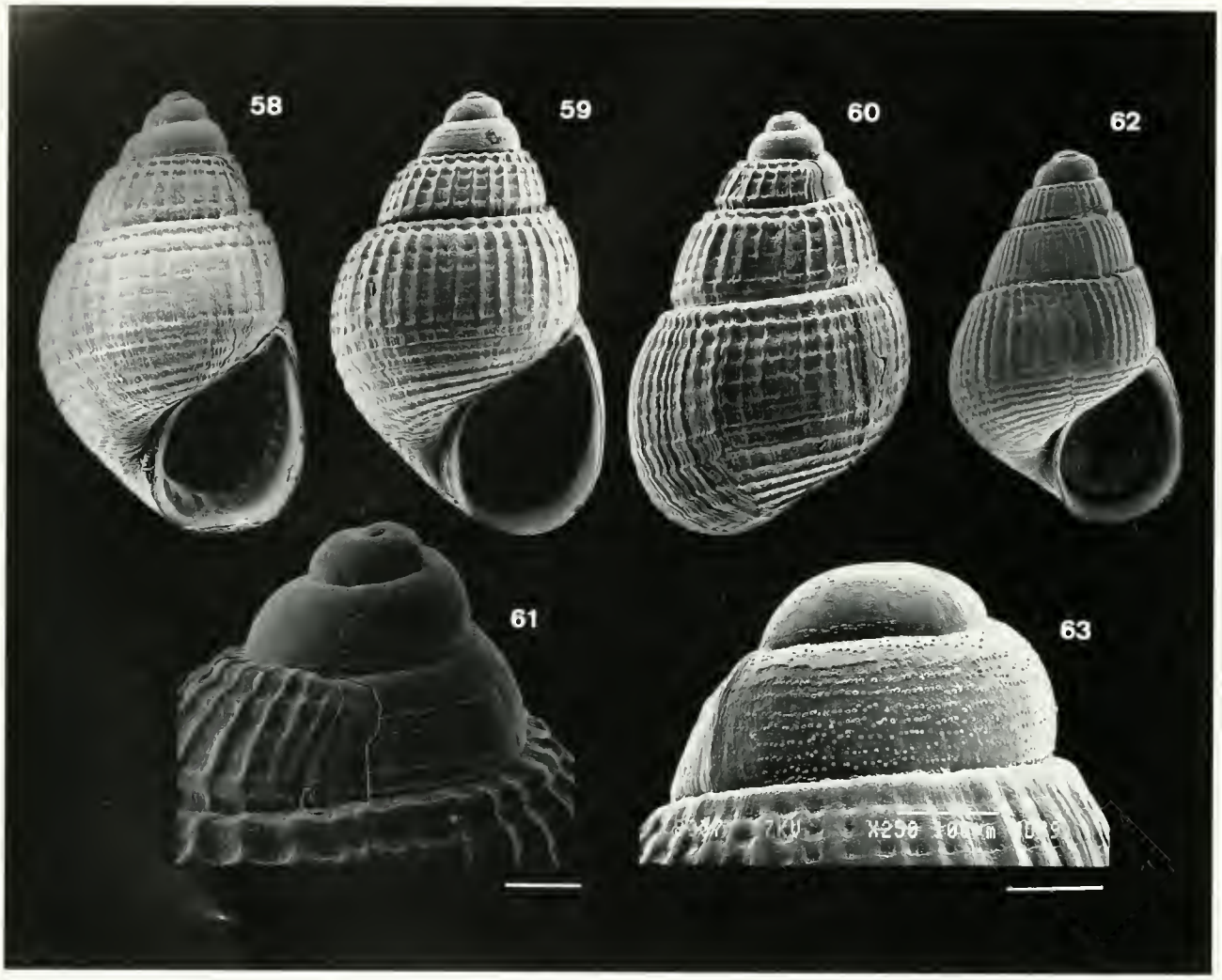
Material examined: Senegal (coll. Marche-Marchad): Off Saloum 50 m, 3 shells (1.75×1.15 to 2.0×1.2 mm); Baie de Gorée, S. of "Tacoma" shipwreck, 25 m, 1 juv shell; SW of Cap Manuel 50 m, 1 shell (1.85×1.15 mm); Casamance (12°46,9′N, 17°29,9′W), 1 shell (1.6×1.15 mm). São Tomé: Morro Peixe, 1 shell (1.85×1.1 mm); Mutamba near Neves, 1 shell (1.85×1.15 mm). Congo: Pointe Noire, Plage mondaine N of lighthouse, 5 shells (1.4×0.9 to 1.55×0.95 mm); Pointe Noire, Plage Orstom dredged 5–7 m, 1 specimen (1.8×1.15 mm), coll. von Cosel, Nov.–Dec. 1985. Angola (coll. Gofas): Type material and off Ambrizete 45 m, 14 shells (1.4×0.95 to 1.5×1.0 mm); Off Ambrizete 80 m, 20 shells (1.35×0.95 to 1.6×1.0 mm); Ambrizete Lighthouse, shore, 8 shells (1.5×0.9 to 1.9×1.2 mm); Barra do Dande, intertidal, 2 specimens + 3 shells (1.8×1.15 to 2.25×1.35 mm); Ilha de Luanda, dredged 40–60 m, 15 specimens + 20 shells (1.4×0.95 to 1.8×1.15 mm); Cabo Ledo, 10–40 m, rocks from tangle nets, 100+ specimens (1 dr.), mostly juvenile (1.75×1.15 mm to 1.50×1.00 mm); Off Mussulo 90–100 m, 15 specimens + 40 shells (1.3×0.9 to 2.2×1.25 mm); Chapéu Armado, intertidal, 30 specimens + 3 shells (1.5×0.85 to 1.65×0.95 mm); Baía das Pipas, intertidal, 1 shell (1.85×1.15 mm); São Nicolau, shore, 400 shells (1.5×0.9 to 2.0×1.2 mm); Praia Amélia, intertidal, 5 specimens (1.5×0.9 to 1.75×1 mm; living animal observed and drawn); Praia Amélia 2–5 m, 23 specimens (1.4×0.9 to 1.65×0.95 mm); Praia Amélia 40–60 m, 1 specimen + 15 shells (1.1×0.75 to 1.5×1 mm); S. of Ponta Albina, 6 shells (1.7×1.1 mm to 1.35×1 mm); Baía dos Tigres, low tide, 5 specimens + 3 shells (1.35×0.9 to 1.5×0.95 mm).

Habitat: Intertidal to outer shelf. On rocky or shell gravel bottom, in crevices percolated by seawater, or in coarse sediment.

Distribution: Senegal; from Congo to southernmost Angola; São Tomé.

Etymology: The specific epithet alludes to the general aspect of the shell, intermediate between typical *Crisilla* and *Alvania*.

Remarks: This species shares a number of characters with the type species of *Crisilla, C. semistriata* (Montagu, 1808). The two species show the same microsculpture on the multispiral protoconch (see Bouchet and Warén, 1993: fig. 1535, for a good illustration), same color pattern of square blotches, and stronger subsutural cords and furrows differentiated from the remainder of



Figures 58–61. *Crisilla transitoria* new species, from Angola. **58.** Paratype, from Palmeirinhas, shell length 1.8 mm. **59.** Holotype, from Corimba, shell length 1.8 mm. **60.** Paratype, from Corimba, shell length 1.75 mm. **61.** Protoconch of the paratype fig. 60. Scale bar = 100 μm.
Figures 62–63. *Crisilla fallax* new species. **62.** Holotype, from off Gorée, (Senegal), shell length 2.0 mm. **63.** Protoconch of a paratype. Scale bar = 100 μm.

whorl. It also lives in the same kind of habitat, in oxide-lined cavities under rocks that are not filled with sediment and through which seawater percolates. *Crisilla transitoria* is distinguished by a more cyrtoconoid profile, a lower spire, more definite axial folds, and presence of yellow stains on tentacles (colorless in *C. semistriata*).

Crisilla fallax new species
(Figures 62–63)

Description: Shell conical, moderately solid, adults 1.6×1.15 mm to 2.25×1.4 mm. Protoconch with 1.3–1.5 whorls, convex, with sculpture of minute granules arranged along spiral lines. Teleoconch with 3.0–3.2 whorls; spire whorls slightly convex, with moderately developed, tightly packed axial folds (ca. 35 on penultimate whorl) and spiral cords; 2 subsutural and 1 suprasutural cords stronger; remaining cords (2 on first teleoconch whorl, 5 on penultimate) weak and not superimposed on axial folds. Body whorl rounded, with 18–20 spiral cords and axial folds gradually fading towards periumbilical area. Outer lip orthocline, smooth inner surface, hardly thickened externally at some distance from edge, which is cutting. Inner lip thin, bordering tiny umbilical chink.

Shell color buff, with 1 row of large, square subsutural brown patches, 1 row of smaller suprasutural brown patches, which continues on body whorl, and spiral rows of smaller patches on periumbilical area.

Type material: Holotype (specimen 2.0×1.2 mm) and 14 paratypes (2 specimens 1.9×1.25 to 2.1×1.25 mm and 12 shells 1.6×1.15 to 2.05×1.25 mm) from type locality, coll. Marche-Marchad (MNHN).

Type locality: S of Gorée, Senegal, 110–112 m.

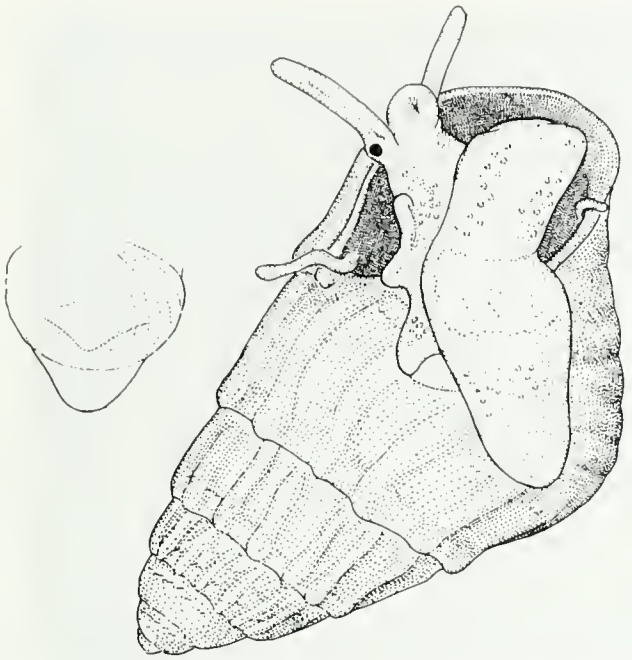


Figure 64. *Benthonellania gofasi* Lozouet, 1990, living specimen from off Mussulo (Angola), shell length 2.0 mm.

Material examined: Senegal: Type material and Dakar area, 95 m, 1 shell (2.25×1.4 mm), coll. Marche-Marchad.

Habitat: Outer shelf, type of bottom unknown.

Distribution: Known only from near type locality, off Senegal.

Etymology: The species name alludes to possible confusion with the other West African *Crisilla*.

Remarks: This species is very similar to *C. transitoria*, sharing with this latter the teleoconch sculpture and color; they differ, however, by the spire profile, which is higher and more regularly conical in *C. transitoria*, not cyrtoconoid, and by the number of teleoconch whorls, one more in *C. transitoria*. The essential diagnostic character is the paucispiral protoconch, which hints at one more case of a pair of similar species, with one species supposedly undergoing planktotrophic development, the other one undergoing non-planktotrophic development.

Genus *Benthonellania* Lozouet, 1990

Type species: *Benthonellania gofasi* Lozouet, 1990, by original designation.

Benthonellania gofasi Lozouet, 1990
(Figures 64–68)

Benthonellania gofasi Lozouet, 1990, p. 314–318, 322–324.

Description: Shell elongate, conical, slightly cyrtoconoid, rather thin, adults 2×1.2 to 2.8×1.6 mm. Protoconch with 2.1–2.4 convex whorls, with irregular spiral threads from which short oblique lines branch-off, forming loosely reticulate pattern; last protoconch whorl with broad smooth spiral zones. Teleoconch with 3–3.5 whorls; spire whorls rather flat with swollen subsutural rim and strong, slightly sinuous axial folds (ca. 20 on first teleoconch whorl, 10–12 on penultimate whorl) terminating adapically by bulge on subsutural rim. Body whorl rounded, with axial folds fading toward periumbilical area, and gradually replaced there by blunt spiral rims. Outer lip not thickened, orthocline. Inner lip thin, leaving small umbilical chink.

Head-foot semitransparent, whitish with tiny opaque white flecks, and poorly defined axial opaque white bar on tentacles. Distinct neck lobe on right side between head and opercular lobe, not present on left side. Snout rather small and cylindrical, with yellow buccal mass visible by transparency. Foot with broad and flat metapodium and very conspicuous, opaque white posterior pedal gland and 1 cluster of small white flecks on propodium sole, and another such cluster on metapodium; no metapodial tentacles. Pallial tentacles slender, colorless, with parallel sides, right one quite conspicuous, left one very small.

Type material: Holotype (specimen 2.15×1.2 mm) and 20 paratypes (MNHN); 2 paratypes (AMS).

Type locality: SW of Cap Manuel, Senegal, 250 m.

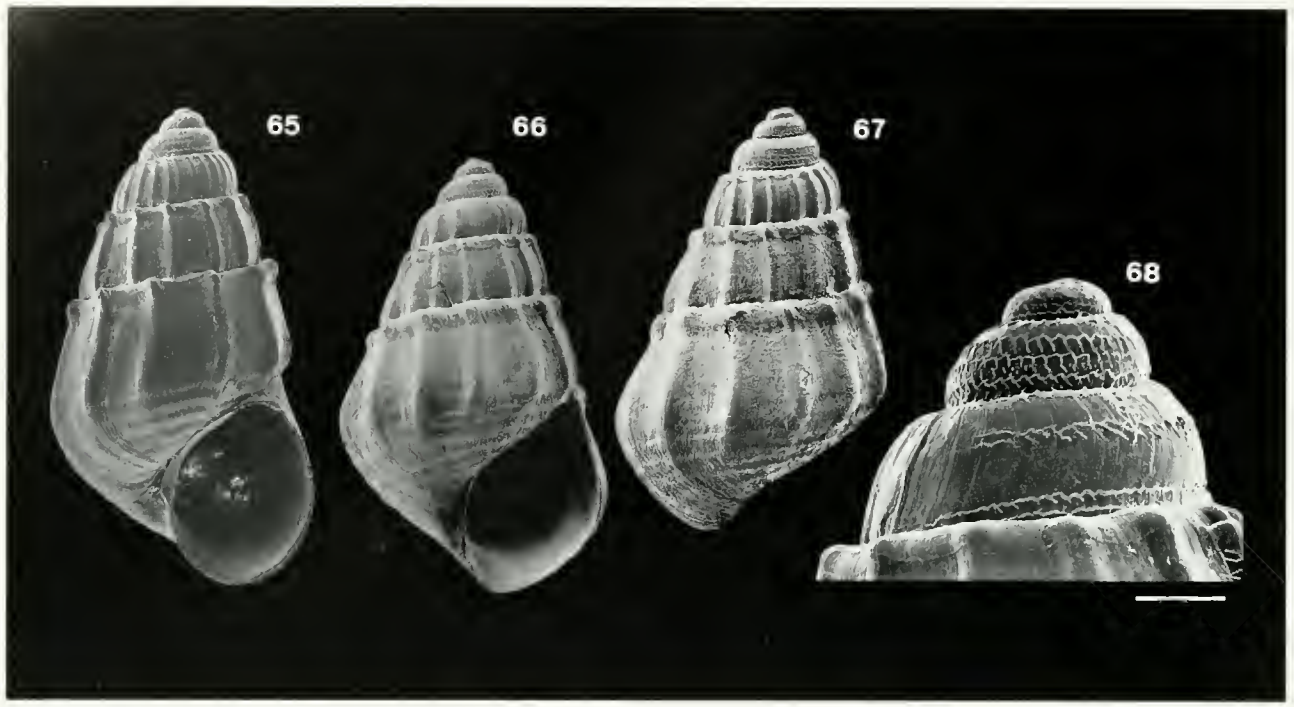
Material examined: Mauritania (coll. Richer de Forges 1981): "N'Diago" sta. 222 (17°42′N, 16°34′W), 200 m, 1 specimen + 1 shell (2.2×1.25 to 2.5×1.4 mm); "N'diago" sta. 243 (17°48′ N, 16°32′W), 200 m, 12 shells (2.0×1.25 to 2.3×1.35 mm); "N'Diago" sta. 244 (17°54′N, 16°32′W), 1 specimen; "Ernst Haeckel" sta. CH268, (18°46′N, 16°51′W), 610 m, 7 shells (1.55×1.0 to 1.7×1.05 mm). Senegal: Off M'Bour, 246 m, 130 specimens (2.2×1.35 to 2.8×1.6 mm), coll. Pin; Dakar area sta. 55–6–3D (14°19′N, 17°23′W), 78 m, 4 specimens, coll. Marche-Marchad; Off Gorée 80–250 m, 9 shells, coll. Marche-Marchad; South of Dakar sta. L4 (14°35′N, 17°35′W), 120 m, 4 shells, (1.9×1.2 to 2.1×1.25 mm), coll. Leung Tak. Angola: Off Ilha de Luanda, 120 m, 140 specimens (mostly juveniles, adults 1.65×1.0 to 2.05×1.25 mm), coll. Gofas.

Habitat: On muddy bottoms of lower shelf and upper slope.

Distribution: From off Essaouira, Southern Morocco (Monaco sta. 1116 cited by Bouchet and Warén, 1993) to Angola. Bouchet and Warén (1993) mentioned its occurrence off Madeira, but did not refer to any record in particular.

Genus *Obtusella* Cossmann, 1921 ex-Monterosato ms.
(new name for *Cingulina* Monterosato, 1884,
preoccupied by *Cingulina* H. and A. Adams, 1860)

Type species: *Rissoa obtusa* Cantraine, 1842 (preoccupied by *R. obtusa* Brown, 1841; = *Rissoa intersecta* Wood, 1857



Figures 65–68. *Benthonellania gofasi* Lozouet, 1990. **65.** Holotype, from off Cap Manuel (Senegal), shell length 2.15 mm. **66–67.** Specimen from off Mussulo (Angola), same as fig. 64, shell length 2.0 mm. **68.** Protoconch of a juvenile specimen from the same locality. Scale bar = 100 μm.

Obtusella intersecta (Wood, 1857)
(Figure 11)

Rissoa obtusa Cantraine, 1842: 348 (preoccupied).
Rissoa soluta (not of Philippi, 1844) sensu Forbes and Hanley, 1850: 131, pl. 75 fig. 3–4.
Rissoa intersecta Wood S.V., 1857: 318 (based on *Rissoa soluta* sensu Forbes and Hanley 1850).
Putilla (Obtusella) cantrainei Nordsieck, 1972, replacement name for *R. obtusa* Cantraine, 1842).

Type locality: "British".

Material examined: Western Europe and Morocco: several hundred specimens from throughout the range. Senegal: Off Saloum 50 m, 4 shells (0.9×0.7 to 1.15×0.8 mm), coll. Marche-Marchad. Angola (coll. Gofas): Ambrizete 45 m, 6 shells (0.6×0.5 to 0.8×0.6 mm); Ambrizete 80 m, 40 shells (0.8×0.6 to 1.1×0.7 mm); Off Ilha de Luanda, dredged 40–60 m, 5 specimens + 44 shells (0.6×0.5 to 0.85×0.7 mm); Off Ilha de Luanda 120 m, 40 shells (0.6×0.5 to 0.8×0.65 mm); Off Mussulo 90 m, 150 shells (0.75×0.6 to 1.05×0.75 mm); Off Mussulo 50–70 m (Macoco), 40 shells (0.70×0.60 to 0.90×0.70 mm), Off Praia Amélia, 40–60 m, 20 shells (0.85×0.7 to 1.0×0.75 mm).

Description: Shell conical, somewhat cyrtoconoid; adults 0.8×0.6 to 1.15×0.8 mm. Protoconch of 2 whorls, apical one depressed, regularly convex with spiral thread adapically next to suture. Teleoconch of 1.7 to 2 whorls; spire whorls quite convex, regularly increasing in size, sculptured with faint, uneven spiral cords (9–12 on penultimate whorl); body whorl rounded with spiral lines continued all over. Aperture pyriform; outer lip orthocline, smooth inner surface, not thickened. Inner lip thin, bordering narrow umbilicus. Shell color buff, uniform.

Habitat: On soft bottoms (muddy sand or mud) of continental shelf, usually between 50 and 200 m.

Distribution: From Northern Norway, the Faroes, southwestern and southern Iceland, to Mediterranean (Bouchet and Warén, 1993), and in West Africa south to southernmost Angola at least.

Remarks: The range of this species is surprisingly large, but there are no morphological or ecological grounds on which the West African populations could be distinguished.

Subfamily **Rissoininae** Stimpson, 1865

Genus *Rissoina* d'Orbigny, 1840

Type species: *Rissoina inca* d'Orbigny, 1840, by original designation.

Rissoina punctostriata (Talavera, 1975)
(Figures 69–73)

Zebina punctostriata Talavera, 1975: 3; pl. 1 fig. 1; pl. 4 fig. 7.

Description: Shell elongate, conical, solid, adults

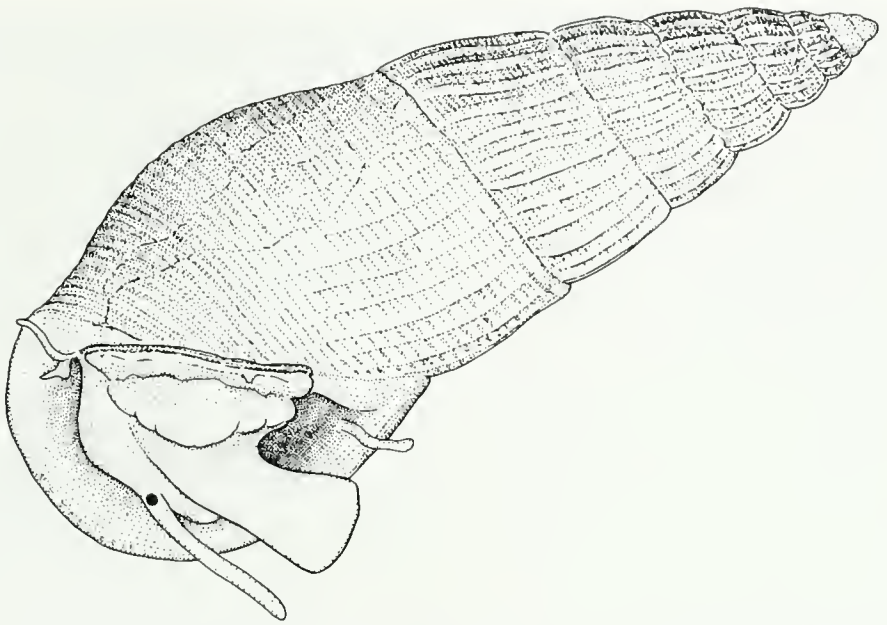


Figure 69. *Rissoina punctostriata* (Talavera, 1975), living specimen from Caotinha (Angola), shell length 7.45 mm.

5.2×2.1 to 8.9×3.5 mm. Protoconch with 2.8–3.2 convex whorls, smooth with spiral thread running adapically along suture of first and second whorl; protoconch/teleoconch transition well-defined, with very deep adapical notch bordered by thickened rim (indicating position of velar lobes during veliger larval stage). Teleoconch with 6–7 whorls, first 2 with strong shoulder, next one becoming gradually slightly convex; body whorl rounded abapically. Surface with oblique axial ribs (ca. 30 on penultimate whorl, becoming more numerous but less distinct on body whorl), and composite spiral microsculpture of uneven spiral threads superimposed by spiral microstriae.

Aperture pyriform, deeply channelled at insertion of outer lip on previous whorl. Outer lip opisthocline, thickened but not demarcated from body whorl; inner surface smooth, meeting external sculptured surface along sharp line. Inner lip slightly thickened, appressed.

Head-foot colorless, with faint brownish hue at tip of snout. Tentacles with parallel sides, slender; eyes at base of tentacles. Snout elongate, markedly with two lobes, with pink buccal mass visible by transparency. Metapodial tentacle hardly visible. Sole of foot colorless, with pedal gland inconspicuous. One small, slender pallial tentacle on right side of aperture; 2 contiguous tentacles on left side, of which innermost is smaller and stouter.

Type material (not seen): Holotype, shell from SAHMAS 1 cruise, sta. EO 8, now in Museo de Ciencias Naturales, Tenerife, TFMC 317 (MO) (F.G. Talavera, pers. comm. 1997).

Type locality: Off Mauritania (18°20′N, 16°10′W), 70 m.

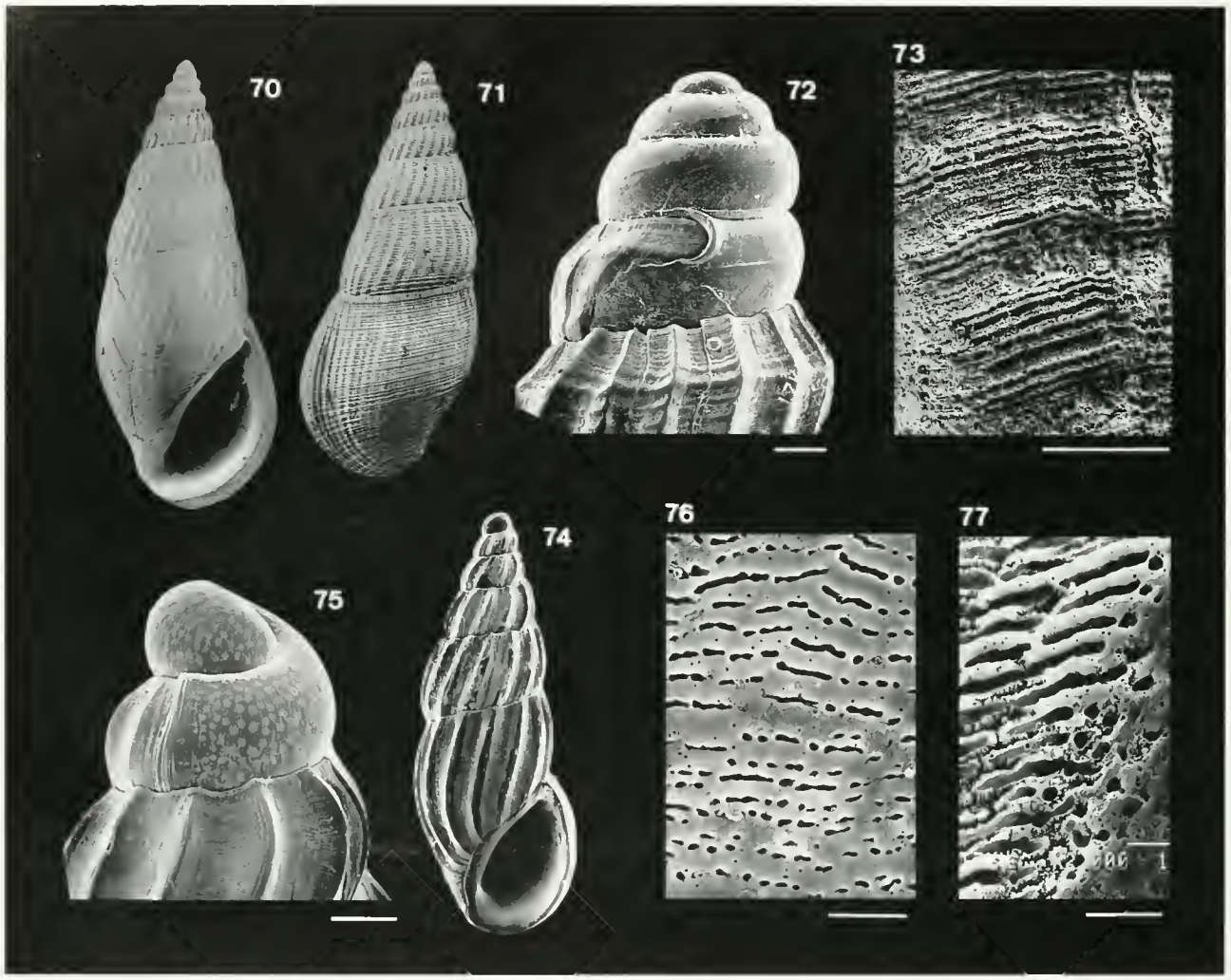
Material examined: Sénégal: Baie de Gorée, 20–30 m, 4 shells (8.3×3.4 to 8.9×3.5 mm), coll. Pin. Côte d'Ivoire: 22 shells (4.25×1.65 to 4.65×1.9 mm). São Tomé: Esprainha, 0–4 m, 2 shells (4.85×2.05 to 6.5×2.6 mm). Gabon: Cap Santa Clara 1–2 m, 3 specimens + 1 shell (7.75×3.2 mm). Cameroun: sta. CC40, (4°04,5 N, 8°42′E), 61 m, 1 shell (5.75×2.45 mm) coll. Monteillet. Angola (coll. Gofas): Off Ambrizete 80 m, 4 juvenile shells; Corimba, rocks with sand 0–1 m, 3 shells (7.4×3.05 to 8.5×3.35); Corimba on sand bar 10–20 m, 10 shells (6.00×2.45 to 6.75×2.8 mm). Palmeirinhas (Buraco), 0–2 m, 1 shell (5.25×2.15 mm); Palmeirinhas 30 m, rocks, 1 shell (5.4×2.3 mm); Off Mussulo 90–100 m, 4 juvenile shells; Caotinha, 1 specimen (7.45×3.05 mm; living animal observed and drawn); Santa Maria, 2 shells (7.25×3.1 to 8.65×3.6 mm); Lucira (Cesar), 10 m, 1 shell (7.25×3.15 mm); Chapéu Armado, 1 specimen (5.55×3.6 mm, broken apex).

Habitat: Under stones among coarse sand and rubble on rocky bottoms, subtidal.

Distribution: West African coast from Western Sahara to Angola; São Tomé; Cape Verde Islands.

Remarks: This species was described from a West African specimen as *Zebina punctostriata* by Talavera (1975), but was later (Garcia-Talavera, 1982) synonymized with the West Indian species *Rissoina decussata* (Montagu, 1803).

The multispiral larval shell, with deep notches for velar lobes, indicates planktotrophic development for both species. However, it can be questioned whether the small larvae of *Rissoina* can routinely cross the Atlantic. *R. decussata* has a more cylindrical protoconch than *R. punctostriata* from Angola or Cape Verde Islands, and lacks the shoulder on the very early teleoconch whorls



Figures 70–73. *Rissoina punctostriata* (Talavera, 1975). **70–71.** Specimen from Caotinha (Angola), same as fig. 69, shell length 7.45 mm. **72.** Protoconch of a juvenile specimen from Caotinha. Scale bar = 100 μm. **73.** Detail of the microsculpture on a teleoconch whorl, same specimen as figs 70–71. Scale bar = 50 μm.
Figures 74–77. *Schwartziella africana* (Dautzenberg, 1913). **74.** Specimen from Dakar (Senegal), shell length 3.2 mm. **75.** Protoconch of another specimen from the same locality. Scale bar = 100 μm. **76–77.** Details of microsculpture of the teleoconch whorls on unaltered (76) and on partially eroded (77) surfaces, same specimen as fig. 74. Scale bars = 10 μm.

(A.A. Luque, pers. comm. 1999); these morphological differences support holding them as separate species.

The distribution of *R. punctostriata* is spotty and the species is usually rare, a pattern of occurrence which is usual in species featuring long-ranging planktotrophic larvae. The population examined from Côte d'Ivoire consists of old, worn shells, possibly subfossil, and differs markedly in having strong axial sculpture, with few strong ribs, thus superficially resembling *Schwartziella africana*. The protoconch is similar to that illustrated in fig. 72.

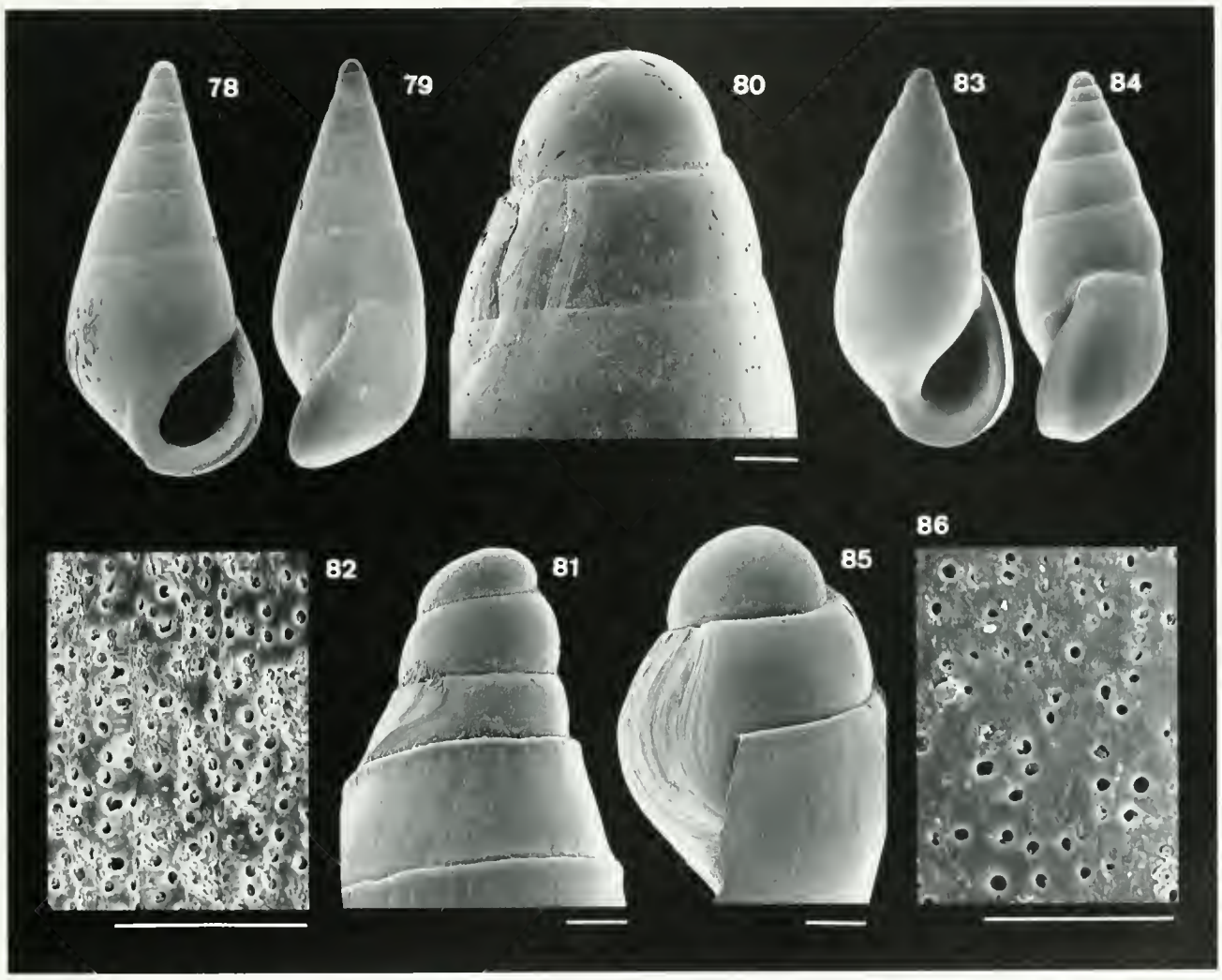
Genus *Schwartziella* Nevill, 1881

Type species: *Rissoina orientalis* Nevill, 1881 (= ? *Rissoina triticea* Pease, 1861), by original designation.

Schwartziella africana (Dautzenberg, 1913)
(Figures 74–77)

Rissoina africana Dautzenberg, 1913: 48–49, pl. 2 fig. 5–6.
Rissoina africana var. *crassior* Dautzenberg, 1913: 49, pl. 2 fig. 7–8.

Description: Shell very high conical, solid, 2.5×1.1 to 5.25×2.15 mm. Protoconch with 1.1–1.3 convex whorls, evenly covered with rounded smeared spots; protoconch/teleoconch transition well defined. Teleoconch with 5–6.5 convex whorls; body whorl broadly rounded abapically. Surface with strong, oblique, slightly sinuous axial ribs (ca. 12 on body whorl), and complex spiral microsculpture of lines of pores and slits, or of irregular striae when eroded (these latter representing underlying structure). Aperture pyriform, not channelled at inser-



Figures 78–80. *Zebina robustior* new species, from Senegal. **78–79.** Shell (holotype) from off Dakar, shell length 5.1 mm. **80.** Protoconch of another specimen from off SW Gorée. Scale bar = 100 μm.
Figures 81–82. *Zebina browniana* (d'Orbigny, 1842) from Santiago de Cuba, Ensenada de Nispero. **81.** Protoconch. Scale bar = 100 μm. **82.** Detail of the microsculpture on a teleoconch whorl. Scale bar = 10 μm.
Figures 83–86. *Zebina paivensis* (Watson, 1873). **83–84.** Specimen from Selvagens Islands, shell length 3.9 mm. **85.** Protoconch of a juvenile specimen from the same locality. Scale bar = 100 μm. **86.** Detail of the microsculpture on a teleoconch whorl. Scale bar = 10 μm, same specimen as figs 83–84.

tion of outer lip on previous whorl. Outer lip slightly opisthocline, thickened but not differentiated from body whorl; inner surface smooth, meeting external sculptured surface along sharp line. Inner lip slightly thickened, appressed.

Type material: Figured syntype of *R. africana* (shell, 3.1×1.35 mm), here designated as lectotype (MNHN); figured syntype of *R. africana* var. *crassior* (3.05×1.4 mm), here designated as lectotype (MNHN).

Type locality: Pointe de Bel-Air (baie de Hann), Dakar (Senegal), intertidal.

Material examined: Senegal: Off Salomm 50 m, sta. 55.3.9, 2 shells (4.9×2 to 5.0×1.9 mm); Dakar 5563D, 3 shells (3.25×1.2 mm), coll. Marche Marchad; Dakar, 10 shells (3.25×1.2 to 3.45×1.45 mm), Staadt collection, MNHN; Joal, 10 shells (3.5×1.45 mm), coll. Mauny; Yoff, intertidal under stones, 5 specimens (2.55×1.15 to 2.85×1.25 mm), coll. Bouchet; Baie de Gorée 50 m, 1 shell (5.25×2.15 mm), coll. Marche Marchad; Baie de Gorée 50 m, 1 shell (5.25×2.1 mm), coll. Marche Marchad; Bel Air, towards "Tacoma" shipwreck, 2 shells (3.15×1.3 to 3.45×1.4 mm); Dakar area, 32 specimens with rusty crust (2.95×1.15 to 3.5×1.4 mm); Baie de Gorée 15 m, 15 specimens (3.15×1.4 to 3.4×1.45 mm), coll. Marche Marchad; Dakar area (14°29′N, 17°23′W), 21 m, 4 shells. Cape Verde Islands: "Sylvana" sta. 136, Maio island, 1 shell (3.45×1.45 mm).

Habitat: Intertidal or shallow subtidal, under rocks.

Distribution: Known with certainty only from a small

stretch of coastline around Dakar, Senegal. The record from Cape Verde Islands is probably based on a mislabeled specimen, as this species was not met with in a large material of *Rissoina* from this archipelago examined by A. A. Luque and E. Rolán (pers. comm., 1999).

Genus *Zebina* H. and A. Adams, 1854

Type species: *Rissoina semiglabrata* A.Adams, 1854 (= ? *Rissoa tridentata* Michaud, 1830), by subsequent designation, Rehder, 1980.

Zebina robustior new species (Figures 78–80)

Description: Shell elongate, conical, solid, glossy, 4.1×1.9 to 5.3×2.4 mm. Protoconch with 1.2 whorls, very globose, smooth. Teleoconch with 6 whorls, spire whorls straight, body whorl rounded abapically. Surface apparently smooth, with scarce tiny punctures visible only under very high magnification. Aperture pyriform, channelled at insertion of outer lip on previous whorl. Outer lip very strongly opisthocline, thickened but not differentiated from body whorl, with rounded edge. Inner surface of outer lip with 2 slightly swollen sections separated by central depression. Inner lip strongly thickened, appressed.

Type material: Holotype (5.1×2.4 mm) from type locality, coll. Marche Marchad, sta. 55–6–3D (MNHN).

Type locality: Off Dakar, Senegal, 14°19′N, 17°23′W, 78 m.

Material examined: Morocco: "Vanneau" sta. 110 (30°23′N, 09°54′W), 110 m, 6 old shells. Mauritania: "Ndiago" sta. 116, 210 m, 1 shell (4.85×2.15 mm), coll. Richer de Forges 1981. Senegal (coll. Marche-Marchad): SW Gorée 150–200 m, 7 (4 juvenile) shells (4.1×1.9 to 4.15×2.0 mm); Off Gorée 50 m, 2 shells; Off Gorée 50 m, sta. 55–7–5A (14°32′N, 17°25,5′W), 1 shell (5.3×2.4 mm); SW Cap Manuel, 2 juvenile shells.

Habitat: Continental shelf.

Distribution: From Southern Morocco to Senegal.

Etymology: The specific epithet alludes to the sturdy, robust shell.

Remarks: This species resembles *Zebina paivensis* (Watson, 1873), a species commonly found on the shores of the Canary Islands and Selvagens, and which authors (Odhner, 1931; Nordsieck, 1972; Garcia-Talavera, 1982) have identified as the West Indian *Zebina browniana* (d'Orbigny, 1842) or *Zebina vitrea* (C.B. Adams, 1850). The Macaronesian populations resemble the Caribbean ones, but differ in having paucispiral instead of multispiral protoconchs, and in having different surface microsculpture. I illustrate here (Figs 81–82) these details from a specimen of *Z. browniana* originating from the same lot as the shell illustrated by Desjardin (1949: pl. 10 fig. 4).

Zebina paivensis has been originally introduced by Watson (1873: 364–365; pl. 36 fig. 29) as *Eulima paivensis*, and was overlooked since then. Its type locality is the coast of the Selvagens, where it is extremely common. I figure (figures 83–86) some topotypes for comparison.

Zebina robustior differs from *Z. paivensis* in being larger, having a strighter profile of spire and whorls and a more globose apex. It is an outer shelf species, in contrast with *Z. paivensis*, which inhabits in beach gravel on the lower intertidal zone of rocky shores.

DISCUSSION

There is apparently very little in common between the West African rissoids group and those from Western Europe and Morocco. The 2 shared species (*Pusillina inconspicua* and *Obtusella intersecta*) belong to genera in which species-level systematics is still confused and where further research may reveal species complexes where 1 single taxon is now recognized.

The *Rissoa* and *Setia* radiations, important in the Mediterranean and still quite well represented in Morocco and in the Canaries, are virtually absent in West Africa. The only representation is the citation of *Rissoa similis* Scacchi, 1836 in Port-Etienne (now Nouadhibou, at the extreme north of the West African province) by Dautzenberg (1913), which is correct but marginal to the West African province. *Rissoa* and *Setia* encompass species that live on algae or marine phanerogams on shallow rocky bottoms. Some lineages in the genus *Alvania*, including species such as the Mediterranean *A. scabra* Philippi, 1836 and *A. discors* (Allan, 1818), which usually live among the photophilous algae, are also apparently absent in West Africa. Most species described herein live either in cavities of rocky substrates, or on outer shelf soft bottoms, and their European relatives, where known, have also the same kind of habitat. This trend may be related to the scarcity of rocky shores suitable for the development of the community of photophilous algae, in most of tropical West Africa. However, it is not explained for Southern Angola where shallow marine environments resemble very much temperate Europe, but where Barleeidae clearly outnumber Rissoidae on the rocky shore (Gofas, 1995).

There are 4 pairs of species with planktotrophic development, and with respectively West African and West European nonoverlapping ranges. These are:

Alvania africana/*A. beani*
Alvania marioi/*A. cancellata*
Alvania gofasi/*A. zetlandica*
Crisilla transitoria/*C. semistriata*

Each one of these species pairs occupies similar habitats and shares similar conchological characters, which suggest that they are closely related. This is in contrast to the usual concept of local radiations where loss of planktotrophy has accompanied, or induced, local dif-

ferentiation. In this case, it is surprising that species with good dispersal ability have not persisted as single panmictic units. A possible scenario is that a single widespread species has been disrupted when increasing North/South climatic contrast has rendered impossible the existence of an extensive latitudinal range, leading the species to either be extinct on part of its range or to split up. This scenario (Endler, 1977) implies that selective pressure induced by changing environmental conditions may lead to discontinuous character distribution and, eventually, speciation along formerly large geographic ranges. This model has been invoked to explain speciation events in planktic species (Pierrot-Bults and van der Spoel, 1979). The model fits with the distributional data of the 4 species pairs mentioned above. Two other species (*Pusillina inconspicua* and *Obtusella intersecta*) with planktotrophic larvae have apparently maintained their large, all-inclusive tropical and temperate range.

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Book Review

Catalogue and Bibliography of the Marine Shell-bearing Mollusca of Japan

by Shun'ichi Higo, Paul Callomon, and Yoshihiro Goto, 1999. Elle Scientific Publications, Osaka, Japan. 749 pp. $130.00

After compiling notes on Japanese Mollusca for some 30 years, Mr. Shun'ichi Higo published, in 1973, a list of Japanese Mollusca, followed by a greatly enlarged and expanded version by Higo & Goto in 1993. These two important catalogues have not been widely utilized as they were written in Japanese. This new catalogue, covering only marine shell-bearing mollusks, is entirely in English and is a very important tool for marine malacologists, listing 6,683 nominal species. This is the first of a two-volume set, the second of which will consist of new color plates of as many type specimens as possible, including all Japanese type specimens in major museums such as the Smithsonian's National Museum of Natural History (USNM), Japan's National Science Museum (NSMT), the Natural History Museum in London (BM(NH)), and in important private collections in Japan, supplemented by photos of non-type specimens from Japan.

The authors' intent is to list every species ever cited from Japan and/or originally described from Japan with original combination, date, and publication reference given for each. Given the nature of the malacological literature there will almost certainly be a few errors and omissions as in all such compilations. However, given the large number of citations and references cited, the number of omissions, if any, must be very few. All taxa are attributed up through the family level and type species are given for genera. The type locality and distribution are given for each species. Habitat, when known, is also included.

There are no manuscript names listed and no fossils unless the species also is found in the Recent fauna. The authors stress that, because this work is compiled from the existing literature, the number of species recorded will almost certainly exceed the number of species actually existing in the area. This compilation provides a platform from which systematists can work.

In addition to a complete citation for each species, the Japanese vernacular name is given. Instead of these names being in *kana* as usually rendered, they have been transcribed into the Roman alphabet with hyphens added to assist in pronunciation. The introduction to the Catalogue gives an overview of the status and importance of these vernacular names, an explanation which has long been needed in English as many non-Japanese wrongly consider the Japanese nomenclature to be a competing system. An index of the Japanese vernacular names is given in the Roman alphabet for the first time.

The systems used to transcribe Japanese *kanji* into the Roman alphabet are explained. The two most widely used systems have both been utilized in malacology, sometimes with odd results. One example of the problems caused by having two systems is that we thus have two very different names, Mr. Ranzi Tiba and Mr. Ranji Chiba, being used for the same person. Some species names based on variant transcriptions are "frozen" into the binominal system, such as *chibanum* and *tibanum*, both proposed for species from Chiba Prefecture.

The short but very important and interesting introduction to the Catalogue explains the use of new distribution maps to indicate ranges for each species and includes information and insights about the Japanese molluscan fauna and its literature not to be found elsewhere. Information about such classic localities as "Kii" and "Tosa", which show up frequently on specimens, but which no longer exist under those names, is also included.

The Catalogue's bibliography is of great importance as it contains not only all original references for marine mollusks described from Japan, but it also lists many works originally written in Japanese with titles translated into English for the first time. This is the largest bibliography of Japanese molluscan works ever published. A listing of Japanese serial publications, including addresses of present publishers if still being printed, is of especial importance as many of these journals are seldom seen outside of Japan.

The book is a fine example of book production. It is A4 in size, printed on cream stock paper and bound in Damascene cloth with a gold stamped leatherette spine. And, as is the case with most Japanese books, it comes in a slipcase.

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The eastern Pacific species of *Sphenia* (Bivalvia: Myidae)

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ABSTRACT

There are four eastern Pacific Ocean species of the genus *Sphenia*: (1) *Sphenia fragilis* (H. Adams and A. Adams, 1854), occurs in a variety of nestling situations from the intertidal zone to shallow water, from Santa Barbara County, California, to Guayas Province, Ecuador, and has as synonyms *S. fragilis* Carpenter, 1857; *S. pacificensis* de Folin, 1867; and *S. truncului* Dall, 1916; as well as the western Atlantic *Corbula iheringiana* Pilsbry, 1897; and *S. antillensis* Dall and Simpson, 1901. (2) *Sphenia gulfensis*, a new species, is restricted to soft bottoms in the Gulf of California. (3) *Sphenia hatcheri* Pilsbry, 1899, occurs, probably in relatively soft substrata, from Rocha Department, Uruguay, through the Estrecho de Magallanes, as far north as Isla Chiloé, Chile; *S. subequalis* Dall, 1908, is a synonym. (4) *Sphenia luticola* (Valenciennes, 1846), occurs offshore in rock cavities from Jefferson County, Washington, to San Diego County, California, and has as synonyms *S. pholadidea* Dall, 1916; *Cuspidaria nana* Oldroyd, 1918; and *S. globula* Dall, 1919. *Sphenia bilirata* Gabb, 1861, may have been based on Recent specimens of *Hiatella arctica* (Linnaeus, 1758). *Sphenia ovoidea* Carpenter, 1864, is based on a juvenile *Mya*, most probably *M. arenaria* Linnaeus, 1758.

INTRODUCTION

Bernard (1983: 58) provided the most recent list with synonymies of the eastern Pacific species of the myoidean genus *Sphenia*. He recognized three: *S. hatcheri* Pilsbry, 1899, in southern Chile; *S. luticola* (Valenciennes, 1846), with a number of synonyms, from northern California to northern Peru; and *S. ovoidea* Carpenter, 1864, from southeastern Alaska to Puget Sound, Washington. At the same time he erected a new subfamily, the Spheniinae, based on two morphological features (Bernard, 1983: 58, 70).

My attention was drawn to some material that proved to belong to *Sphenia* from the Golfo de California and that had been misidentified as a new species of *Basterotia*, a genus of the Sportellidae, which I was then studying. When that review was completed (Coan, 1997; 1999), I returned to this material, which proved instead to be a new species of *Sphenia*. Examination of the available eastern Pacific material of *Sphenia*, including the type material of the described species, has resulted in conclusions that differ significantly from those of Bernard (1983).

Previous taxonomic lists and studies of *Sphenia* include those of A. Adams (1851), Tryon (1869: 67), E. A. Smith (1893), Lamy (1927: 176–184), Lewis (1968), and Hanks and Packer (1985). Baluk and Radwański (1979) discussed the morphological variability of the Miocene *Sphenia anatina* (Basterot, 1825: 92) caused by its nestling site.

Forbes and Hanley (1848: 189–193) were the first to describe the anatomy of a species of *Sphenia*, *S. binghami* Turton, 1822, from notes provided by William Clark. Yonge (1951) reviewed the functional morphology of *S. binghami*, and Narchi and Domaneschi (1993) that of *S. antillensis* Dall and Simpson, 1901.

Some species, such as *S. binghami*, nestle in rock crevices and similar situations, whereas others, such as *S. antillensis*, are somewhat more widespread nestlers, occurring among colonial ascidians, polychaete tubes, and the byssal threads of mytilid clams. *Sphenia sincera* Hanks and Packer, 1985, occurs in soft bottoms, but there is not yet an account of how its functional morphology differs from the two taxa studied thus far.

FORMAT

In the following treatment, each valid taxon is characterized by its synonymy, description, information on type specimens and type localities, notes on distribution and habitat, and an additional discussion.

The synonymies include all major taxonomic accounts about the species, but not most minor mentions in the literature. The entries are arranged in chronological order under each species name, with changes in generic allocation from the previous entry, if any, and other notes given in parentheses.

The distributional information is based on Recent specimens I have examined, except as noted. Fossil occurrences are taken from the literature.

The following abbreviations are used in the text: AMNH, American Museum of Natural History, New

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York, New York, USA; BM(NH), The Natural History Museum, London, England; CAS, California Academy of Sciences, San Francisco, California, USA; LACM, Natural History Museum of Los Angeles County, California, USA; MACN, Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina; MNHN, Muséum National d'Histoire Naturelle, Paris, France; SBMNH, Santa Barbara Museum of Natural History, Santa Barbara, California, USA; UCMP, University of California Museum of Paleontology, Berkeley, California, USA; USNM, National Museum of Natural History, Smithsonian Institution, Washington, DC, USA; UMML, Marine Invertebrate Museum, Rosenstiel School of Marine and Atmospheric Science, Miami, Florida, USA; Skoglund Collection, collection of Carol C. Skoglund, Phoenix, Arizona, USA.

MORPHOLOGICAL CHARACTERS

Due to the nestling habitat of most species, overall shell shape is not an easily used character in identification of species. Variability in shape is illustrated in the material figured herein. Some species of *Sphenia*, such as *S. luticola* and *S. anatina*, are highly variable in shape, inhabiting pre-established cavities in relatively hard substrata. *Sphenia fragilis*, nestling amongst such materials as bryozoan colonies, is only slightly less variable. Those species occurring in softer substrata, such as *S. sincera*, and presumably *S. gulfensis* and *S. hatcheri*, retain a more defined shape.

While the shape of the ends, especially the posterior end, is also variable, the degree of elongation and inflation of the anterior end is a useful character that helps, for example, to distinguish *S. fragilis* from *S. gulfensis*.

The periostracum differs among species. The extent to which the periostracum and, in one case, the outer shell layer, extend the posterior end is particularly important in species distinction.

The chondrophore in the left valve, while exhibiting variability in size and shape, provides at least three useful characters. In small specimens of all species, it is approximately horizontal. As some species reach their maximum size, it may become more vertical, such as in *S. luticola*. Also useful is the degree of elongation of the posterior attachment (the "posterior buttress") and the length of the posterior ridge (figures 1, 18–22).

The placement of the anterior muscle scar—located either close to the ventral margin or more toward the middle of the anterior margin—proves to be a useful specific character. The extent to which the posterior adductor muscle scar and the pallial sinus are recessed from the posterior end is also a useful character. These features are illustrated with line drawings (figures 18–22).

Finally, the size of the discontinuous scars defining the pallial sinus differs among the four eastern Pacific species.

The most important specific characters are given in Table 1.

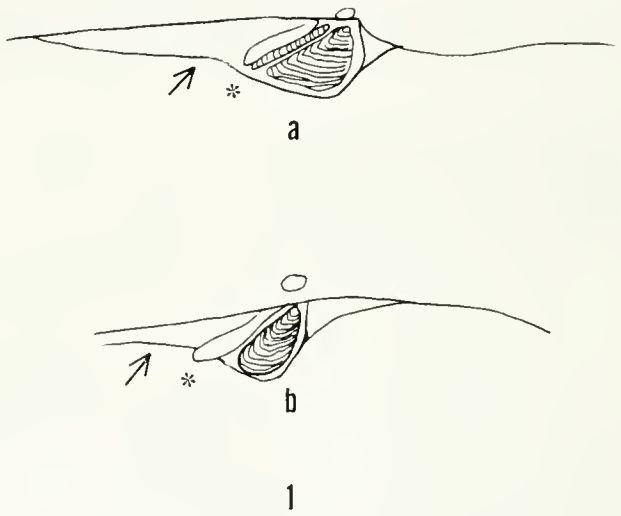


Figure 1. Contrasting features of the chondrophores of two species of *Sphenia*. (a) *S. gulfensis* and (b) *S. luticola*. The first has a long posterior buttress (arrow) in contrast to the latter. The second has a long, projecting posterior ridge (asterisk) in contrast to the first.

SYSTEMATICS

Family Myidae Lamarck, 1809: 319, as "Myaires"
Subfamily Cryptomyinae Habe, 1977: 279

This subfamily is thus far distinguished from the Myinae only on the basis its short siphons and shallow pallial sinus.

Bernard (1983: 58, 70) proposed the Spheniinae based on two characters: (1) the "resilifer" in the left valve was said to be "only superficially similar" to the "chondrophore" of *Mya*, and (2) "the lateral tubercles of the right valve have no counterpart in *Mya*."

I believe that this rationale is indefensible. In the first instance, a chondrophore is merely a hollowed-out, projecting resilifer, and the left valves of both *Sphenia* and *Mya* have similar structures. *Mya* attains a much larger size than *Sphenia*, and its chondrophore ultimately becomes more prominent. However, at an equivalent size, the chondrophores and their features in the two genera are virtually identical. Indeed, in describing a new species of *Sphenia*, Hanks and Packer (1985) use terminology for chondrophore features first proposed for those of *Mya* by MacNeil (1965) and earlier authors. Bernard's reference to "lateral tubercles" in *Sphenia* is equally perplexing. The eastern Pacific species of *Sphenia* have a small, slightly projecting anterior cardinal tooth in the right valve, varying in prominence among species; there is no posterior tooth. There is no projecting anterior cardinal tooth in *Mya* of equivalent size, but the posterior end of its anterodorsal margin may be expanded and turned ventrally just anterior to the resilifer. The presence or absence of a small tooth may differentiate members of the two genera, but it does not seem to be a fundamental difference.

Bernard's differentiation of the Spheniinae from *Mya*

Table 1. Key differentiating characters, size, and frequency of eastern Pacific *Sphenia*. Total 204 lots.

	Shell thickness/ shape	Anterior end	Chondrophore orientation/ posterior ridge	Anterior adductor muscle scar	Posterior adductor muscle scar and pallial sinus	Max. size, mm	Number of eastern Pacific lots studied
Sphenia fragilis	Thin/variable—ovate, ovate-elongate, sub quadrate	Proportionately inflated	Horizontal, but a little ventrally/ ridge not projecting	Near ventral margin	Close to posterior end	12.7	138
Sphenia gulfensis	Thin/elongate	More inflated, but tapering gradually	Horizontal/ridge not projecting	Central	Recessed from posterior end	13.1	31
Sphenia hatcheri	Moderate/elongate	More inflated, but tapering gradually	Equal horizontally and ventrally/ridge slightly projecting	Near ventral margin	Recessed from posterior end	30.1	1
Sphenia luticola	Thick/variable—ovate, elongate	More inflated, but tapering gradually	More ventral/ ridge projecting	Near ventral margin	Close to posterior end	20.6	34

is still more puzzling, because *Sphenia* had until then been placed in the Cryptomyinae Habe, 1977, which he also recognized. It was originally erected for myids with short siphons, and into it Habe placed *Cryptomya* Conrad, 1849: 121; *Distugonia* Iredale, 1936: 283; *Paramya* Conrad, 1860: 232 [*nomen novum pro Myalina* Conrad, 1845: 65, *non* Konnick, 1842: 125][2]; *Sphenia*; and *Venatomya* Iredale, 1930: 403.

Overall relationships among the genera of Myidae could be inferred from cladistic analysis of an array of anatomical and shell morphological characters. The subfamily Cryptomyinae currently stands on minimal grounds.

Genus *Sphenia* Turton, 1822

Sphenia Turton, 1822: xvii, xxiii, 36–38, 261 (*ex* Leach ms. according to Gray, 1847). Type species: *Sphenia binghami* Turton, 1822: xxiii, 36–37, 257, 277, pl. 3, figs. 4, 5; by the subsequent designation of Gray (1847: 190). A lectotype for this species was designated and figured by Hanks and Packer (1985: figs. 1, 2).

Shaenia, *Spaena*, *Sphaena*, *Sphaenia*, *Sphaeria*, *Sphena*, *Spenia*, *Splenica*, *Sphoenia*, *Syphonia*, misspellings of authors.

Tyleria H. Adams and A. Adams, 1854: 418. Type species: *Tyleria fragilis* H. Adams and A. Adams, 1854: 418; by monotypy.

Tileria, misspelling of authors.

Description: Shell medium-sized to small, irregular in shape in nestling species. Posterior end truncate. Chondrophore narrow to somewhat projecting. Small anterior cardinal present in right valve. Pallial sinus shallow. Pallial line a series of discontinuous scars. Siphons short and united, with tips surrounded by single, common row of short tentacles. Incurrent siphon circled by additional row of tentacles, excurrent siphon with tubular valvular membrane. Ctenidia large and unplicated, inner demibranch larger, with supra-axial extension. Palps small and differing in size between species. Foot small, narrow, serving in *S. binghami* and *S. antillensis* to attach the byssus to hard substrata.

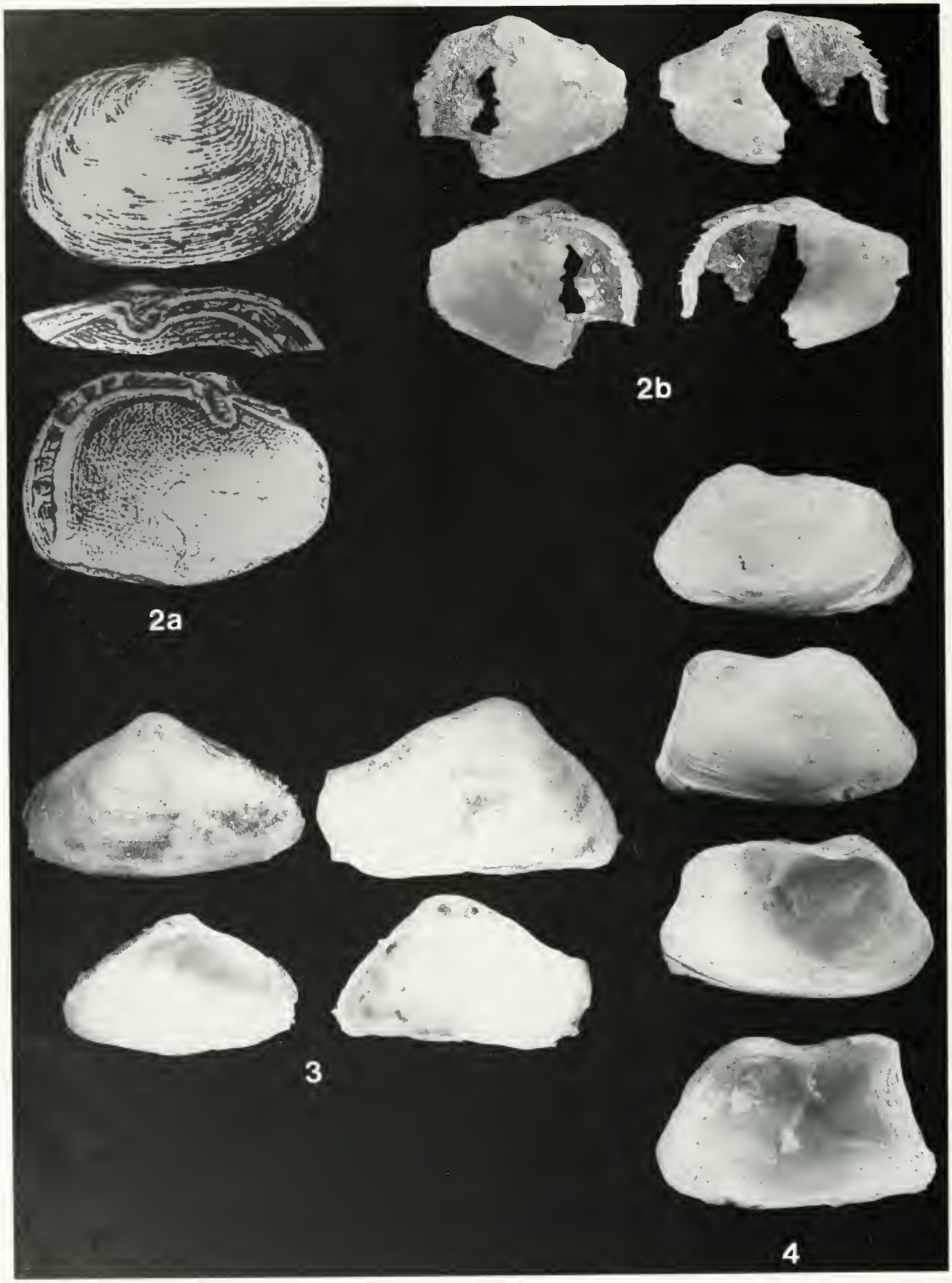
Sphenia fragilis (H. Adams and A. Adams, 1854) (Figures 2–6, 18, 24)

Tyleria fragilis H. Adams and A. Adams, 1854: 418; 1856: 368, pl. 97, figs. 3, 3a; Carpenter, 1857a: 245, 300; 1857b: 25 (as a possible synonym of *Sphenia fragilis* Carpenter), 547–548 (as something unique); Keen, 1968: 400–401 (as a senior synonym of *S. fragilis* Carpenter); Bernard, 1983: 58 (as a synonym of *S. luticola*)

Sphenia fragilis Carpenter, 1857a: 244, 300, *nomen nudum*; 1857b: 24–25, 530; 1864: 543 (as a possible synonym of *P. luticola*), 553, 619 (1872: 29, 39, 105); de Folin, 1867: 53 [= 15], pl. 2, figs. 7–9; Tryon, 1869: 67; E. A. Smith, 1893: 279; Oldroyd, 1924: 62–63; 1925: 200; Lamy, 1927: 179–180 (as a synonym of *P. luticola*, but under the heading of *S. fragilis*); Palmer, 1951: 13, 1958: 116; Keen, 1958: 207, fig. 521; Franc, 1960: 2120–2121, fig. E; Olsson, 1961: 424–425, 550, pl. 77, fig. 9, 9a, b; Brann, 1966: pl. 6, fig. 35 (tablet 80); Keen, 1968: 394, 400–401, fig. 22a–c; 1971: 262, 263–264, fig. 673; Bernard, 1983: 58 (as a synonym of *S. luticola*)

Sphenia pacificensis de Folin, 1867: 53–54 [= 15–16]; de Folin and Périer, 1867: 8 (as *pacificiensis*); Crosse, 1868: 218 (as *pacifica*, unjustified emendation); von Martens, 1868

[2] Placement of the genus *Paramya* remains a mystery. The resilifers in the two valves are equally recessed and U-shaped, very different from those of other myids. There is no pallial sinus, and the external shell surface is pustulose, the latter suggesting to Campbell (1993:33) that it the species might be a member of the Sportellidae. Moreover, like the sportellid genus *Anisodonta* Deshayes, 1858:542, *Paramya* has a thick internal radial rib just posterior to the anterior adductor. However, sportellids have not been reported to have large internal ligaments. Only an examination of the anatomy of this genus will resolve its taxonomic position.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586 (as *pacifica*); E. A. Smith, 1893: 280, pl. 15A, fig. 7 (as *S. pacifica*); Keen, 1958: 207 (as a variety of *S. fragilis*); Kisch, 1960: 149, 162; Lamy, 1927: 181; Keen, 1971: 263 (as a synonym of *S. fragilis*); Bernard, 1983: 58 (as a synonym of *S. luticola*)

Corbula iheringiana Pilsbry, 1897a: 8, *nomen nudum*; 1897b: 295, pl. 7, figs. 24–26; Figueiras and Sicardi, 1970a: 411, pl. 5, fig. 78

Sphenia antillensis Dall and Simpson, 1901: 474, pl. 55, fig. 14; Lamy, 1927: 181; Warmke and Abbott, 1961: 205–206, pl. 43, fig. e; Abbott, 1974: 537; Vokes and Vokes, 1983: 44, 65, 164, pl. 48, fig. 17; Narchi and Domaneschi, 1993: 195–210; Rios, 1994: 291, pl. 99, fig. 1419

Sphenia truncatula Dall, 1916a: 41, *nomen nudum*; 1916b: 415; Oldroyd, 1925: 201; Lamy, 1927: 181; Bernard, 1983: 58 (as a synonym of *S. luticola*)

Sphenia luticola Valenciennes, *auctt., non* Valenciennes, 1846. Gemmell et al., 1987: 58, fig. 71

Description: Shell thin, ovate to ovate-elongate to subquadrate; shape variable, depending on habitat; right valve slightly more inflated, often overlapping left valve at postero-ventral margin in less distorted specimens; anterior end generally short, broadly rounded, particularly inflated; posterior end from short to produced, truncate posteriorly, sometimes twisted to left or right, often extended by periostracum, slightly gaping. External surface with fine commarginal ribs; periostracum thin, dark to light tan, adherent. Left valve with medium-sized to large, triangular chondrophore, projecting towards right valve, but also somewhat ventrally; posterior buttress short; posterior ridge not much extended beyond ventral edge of chondrophore. Right valve with resilifer under beaks, more deeply recessed than that of *S. luticola*, and with small anterior cardinal tooth. Anterior adductor muscle scar positioned ventrally. Posterior adductor scar and pallial sinus close to posterior end. Pallial sinus a series of 2–4 narrow scars; pallial line a discontinuous series of small, rounded scars (Figure 18). Length to 12.7 mm (USNM 733245; Fort Amador, Canal Zone, Panamá); in the western Atlantic, to 14.6 mm (Narchi and Domaneschi, 1993: 196, misprinted as "146 mm").

Type material and localities:

T. fragilis—BM(NH) 1878.1.28.64, holotype (figure 2a, b); length, 6.3 mm; height, 5.0 mm; thickness cannot be measured because of breakage. Mazatlán, Sinaloa, México (23.2°N); nestling in a sand-filled cavity in a *Spondylus* valve; R. W. Tyler. The holotype is now badly broken. Copies of the original figures as well as photographs of the present state of the specimen are provided here.

S. fragilis—BM(NH) Carpenter Mazatlán Collection 1857.6.4.82/1 [species 35, tablet 82], lectotype herein designated, the largest set of paired valves, length, approximately 8 mm; height, approximately 4.9 mm; thickness cannot be measured because specimen glued on slide (Figure 3); this specimen was figured by Keen (1968: figs. 22a, b). Paralectotypes: BM(NH) 1857.6.4.82/2, one left valve glued on same slide; 1857.6.4.81/1–6, 5 smaller pairs, some of which are broken, on slide, one loose valve; 1857.6.4.80/1–14, 10 still smaller pairs and four valves on slide; USNM 715649, 40 pairs, valves, and fragments. Mazatlán, Sinaloa, México (23.2°N); inhabiting the burrows of worms and mollusks in shells of chamids and *Spondylus*; also in dead barnacles on *Strombus*; F. Reigen.

S. pacificensis—BM(NH) 196460/1, lectotype herein designated, the only intact pair; length, 5.8 mm; height, 3.6 mm; thickness, 3.4 mm (Figure 4). BM(NH) 196460/2–3, paralectotypes, 1 pair with right valve broken anteriorly, length, 5.2 mm; 1 pair with both valves broken, length, approximately 6.2 mm. Archipiélago de las Perlas, Panamá (approximately 8.4°N).

C. iheringiana—ANSP 70541, lectotype herein designated, closed pair; length, 9.0 mm; height, 5.6 mm; thickness, 3.8 mm (Figure 24); ANSP 401333, paralectotypes, 1 right valve, length 7.4 mm; 1 open pair, length, 6.5 mm; 1 closed pair, length, 3.9 mm. Bahía Maldonado, Maldonado Department, Uruguay (34.9°S); 3–6 fms. [6–11 m].

S antillensis—USNM 160495, holotype, pair; length, 4.0 mm; height, 2.5 mm; thickness, 4.5 mm (Figure 5). Playa del Ponce, Puerto Rico (18.0°N, 66.6°W). The right valve of this pair is now split but not broken.

S. truncatulus—USNM 160116, lectotype herein designated, closed pair; length, 6.9 mm; height, 5.0 mm; thickness, 3.8 mm (Figure 6); USNM 880250, paralectotype, smaller closed pair; length, 6.6 mm. San Diego, California (32.7°N); among barnacles on wharf piles.

Distribution and habitat: Carpinteria, Santa Barbara County, California (34.6°N) (LACM 77-30.22, SBMNH 31575), throughout the Golfo de California, to its head at Puerto Peñasco, Sonora, México (31.3°N), south to Salinas, Guayas Province, Ecuador (2.2°S) (CAS 110971); intertidal zone to 55 m [3] (mean, 4 m; n = 50), nestling in pre-existing holes in rock, wood, and other mollusks, and among bryozoan colonies and in similar situations. A record from Zorritos, Tumbes Province, Perú (3.7°S) (Olsson, 1961: 425), could not be verified and was perhaps based on a specimen of *Aligena* (UMML 30.10456); in the western Atlantic from Hunting Island State Park, South Carolina (32.3°N) (L. D. Campbell, in correspondence, 19 July 1997), Saint Lucie

[3] The specimen forming the basis of Durham's (1942:121) record of "*Sphenia* sp." from 393 m west of Isla Tiburon, Sonora, México, cannot now be located in the UCMP, and thus a deep record of either this or the next species cannot be confirmed. The specimen might have proven to belong to some other genus and has now been filed elsewhere.

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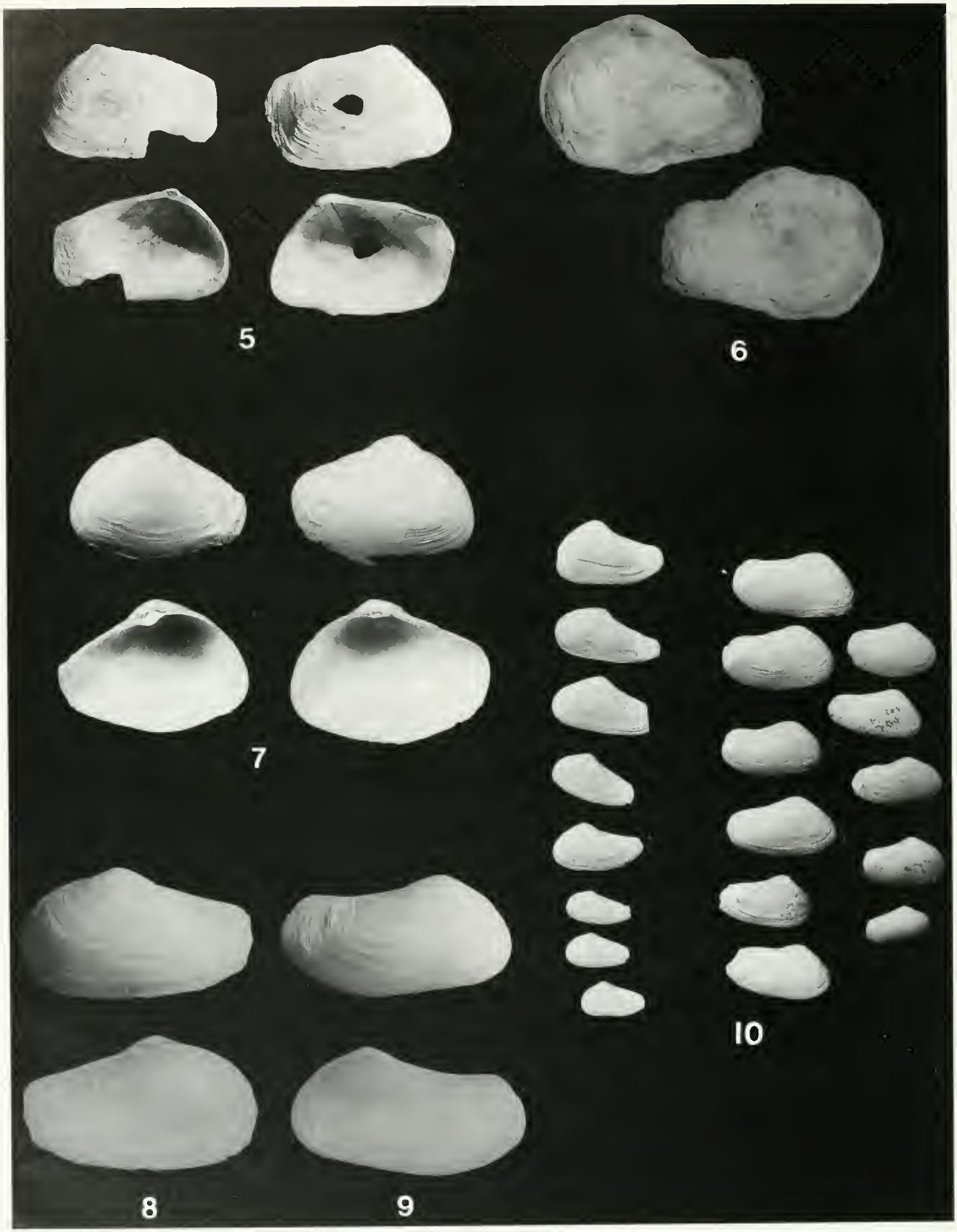
Figures 2–4. *Sphenia fragilis* (H. Adams and A. Adams). **2.** Holotype of *Tyleria fragilis* H. Adams and A. Adams, BM(NH) 1878.1.28.64, length = 6.3 mm. (a) Figures of H. Adams and A. Adams (1856); (b) photographs of current state of specimen. **3.** Lectotype of *Sphenia fragilis*, BM(NH) Carpenter Mazatlán Collection 1857.6.4.82/1, length = 8 mm (external view through glass slide). **4.** Lectotype of *Sphenia pacificensis*, BM(NH) 196460/1, length = 5.8 mm.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(USNM 861964) and Sanibel Island (SBMNH 144631), Florida, and South Padre Island, Texas (Abbott, 1974), to Santa Catarina State, Brazil (approx. 28°S) (Rios, 1994), and south to Bahía Mandonado, Maldonado Department, Uruguay (34.9°S) (type locality of *Corbula iheringiana*; SBMNH 145228). I have seen 138 eastern Pacific lots and about 30 western Atlantic lots.

Discussion: *Tyleria fragilis* was proposed as a new genus and species by H. Adams and A. Adams in 1854 for a "curious little shell" found nestling in a sand-filled cavity in a *Spondylus* valve. Figured by these authors two years later, it was characterized as having a chondrophore and a short pallial sinus like a *Sphenia*, but it was also said to have a partly external ligament and the anterior end was said to have a ridge below the dorsal margin supported by a series of calcareous septa dorsal to it (figure 2a).

When Carpenter (1857b: 24) first discussed *Tyleria fragilis* (in a portion of the Mazatlán Catalogue typeset in 1855), and having seen only a drawing of it, he said, "I have occasionally noticed valves of *Sphenia* with a tendency towards the same crenation at the posterior end, apparently through the irritation of sand." (He evidently confused or misstated which end had the "crenation.") Later, in a portion of his book typeset in 1857 (p. 547), he said that he had seen the actual specimen and concluded that it was unique, not a *Sphenia*; in the same work he described *Sphenia fragilis* as a new species, thus selecting the same species name.

When Myra Keen examined the holotype of *Tyleria fragilis* in The Natural History Museum in London she concluded that it really was a pathological specimen of *Sphenia* in which the shell material was "either not deposited or was resorbed" along the dorsal margin, leaving "a few islands of solid calcium carbonate embedded in what is mostly periostracum" (Keen, 1968). (Periostracum bridging the two valves probably accounts for the Adams' observation of an external ligament.)

The holotype of *Tyleria fragilis* remains a puzzle. I have been able to examine only photographs of the specimen, which is now too fragile to travel. The specimen was badly eroded from the start and has since been much broken; the outer periostracal layer is now mostly gone. The "calcareous septa" seen by the Adams' and the "islands of solid calcium carbonate" observed by Keen now appear with loss of the periostracum to resemble short radial ribs (figure 2b). No other specimens of *Sphenia* have been seen like this, and it may have been caused by the animal's nestling site. On the other hand, the shallow pallial sinus defined by a series of discontinuous scars comports with *Sphenia*. The chondrophore and resilifer also fit this genus; while both seem distorted, such distortion is not unusual. A greater comfort level with the identity of the specimen could be achieved by close examination of the chondrophore, because that of myids has unique features. While I have not seen other specimens of *Sphenia* with its singular morphology, no other known nestling clam better explains the specimen, and it is best to leave the synonymy of the two species named *fragilis* as it is.

The type specimen of *Sphenia antillensis* is small, flat, and now chipped (figure 5). All other western Atlantic material I have examined, including the 23 lots available in the USNM, specimens in museums on the west coast, and a set of the material studied by Narchi and Domaneschi (1993) [SBMNH 145246], is indistinguishable from eastern Pacific specimens of *Sphenia fragilis* in all features here found to be useful here in distinguishing species *Sphenia*—shell shape and thickness, maximum size, chondrophore orientation and morphology, pallial sinus details, and positions of the adductor muscle scars, as well as in reported habitat.

The nomenclatural situation is further complicated by the fact that *Sphenia antillensis* is not even the earliest name available in the western Atlantic. The first name proposed for a Recent western Atlantic *Sphenia* is *Corbula iheringiana* based on material from Uruguay, with a lectotype figured here with a photograph for the first time (figure 24).

Because of the fact that western Atlantic material cannot be distinguished from eastern Pacific material by any criteria found useful at the species level in this genus, it is inescapable to use the first name proposed until such time as significant differences are discovered.

Given its shallow habitat and presence in fouling communities, it is not impossible that *Sphenia fragilis* has been transported by ship traffic during the last 300 years either to the east or the west. As evidence that such transport can occur in this genus is the recent discovery of a few specimens of *Sphenia* in Pearl Harbor, Oahu, Hawaii (SBMNH 144633). This material has been tentatively identified as the western Pacific *Sphenia coreanica* Habe, 1951:76, based on its heavier commarginal sculpture and pallial sinus positioned further from the posterior end. (Habe's original material was small and oval, and had not grown the elongate posterior end typical of larger specimens.) However, the relationships of this material and of western Pacific *Sphenia coreanica*

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Figures 5–7. *Sphenia fragilis* (H. Adams and A. Adams). **5.** Holotype of *Sphenia antillensis*; USNM 160495; length, 4.0 mm. **6.** Lectotype of *Sphenia truncula*, USNM 160116, length = 6.9 mm. **7.** SBMNH 144630, Puerto Peñasco, Sonora, Mexico, length = 9.1 mm.

Figures 8–10. *Sphenia gulfensis* new species. **8.** Holotype, left valve, SBMNH 144627, length = 11.7 mm. **9.** Paratype, right valve, SBMNH 144628, length, = 0.6 mm. **10.** Lot showing variability in shape, SBMNH 144345, Puertecitos, Baja California (Norte), 18 m.

to the eastern Pacific *S. fragilis* merits additional study, ideally augmented with information from biochemical genetics.

Sphenia gulfensis new species
(Figures 1a, 8–10, 19, 20)

Description: Shell thin, elongate; anterior end produced, broadly rounded, tapering in thickness gradually from anterior to posterior end; right valve more inflated, generally extending well beyond posteroventral margin of left valve; posterior end often very elongate, tapered vertically, broadly truncate, sometimes flared, narrower in left valve, not extended by periostracum, slightly gaping. External surface with fine commarginal ribs. Periostracum thin, very light tan, adherent. Left valve with narrow chondrophore, projecting horizontally toward right valve, even in large specimens; posterior buttress elongate in large specimens; posterior ridge not extending beyond ventral margin of chondrophore. Right valve with resilifer more deeply recessed than that of *S. fragilis*, and with more conspicuous anterior cardinal tooth. Anterior adductor scar at middle of anterior end. Posterior adductor scar and pallial sinus well recessed from posterior margin. Pallial sinus a series of 3–4 narrow scars; pallial line a discontinuous series of small, rounded scars (figures 19, 20). An additional lot is illustrated to show the variability in shape of this species (Figure 10). Length to 13.1 mm (SBMNH 144345; Puertecitos, Baja California [Norte], Golfo de California).

Type material: SBMNH 144627, holotype, left valve; length, 11.7 mm; height, 6.6 mm; thickness, 2.2 mm (Figure 7, 19); SBMNH 144628, figured paratype, right valve; length, 10.6 mm; height 5.9 mm; thickness, 1.9 mm (figures 8, 20); SBMNH 144629, four additional paratypes, of lengths 12.8 mm (right valve), 12.0 mm (left valve), 11.1 mm (right valve), 11.0 mm (left valve), all from type locality, Peter and Sally Bennett, March 1976.

Type locality: San Felipe, Baja California (Norte), Gulf of California, Mexico (31.0°N, 114.8°W), 15–22 m, mud bottom.

Distribution: Puerto Escondido, Baja California Sur (25.8°N) (CAS 112929), northward to the head of the Gulf of California at Bahía Cholla, Puerto Peñasco, Sonora (31.4°N) (SBMNH 115752, UCMP E8398, Skoglund Coll.), south to Mazatlán, Sinaloa (23.2°N) (UCMP E9704), Mexico, from the intertidal zone to 61 m (mean = 15 m; n = 13), on soft bottoms. I have examined 31 lots.

Discussion: This species has sometimes been separated in collections as differing from *S. fragilis*. Stillman Berry recognized it in material he had collected at Puerto Peñasco, Sonora, in 1949 and 1952 (SBMNH 115752), and I isolated it aside in material I had collected at San Felipe, Baja California (Norte), in 1963 (UCMP E9705).

This new species differs from *S. fragilis* as follows: (1) the anterior end of *S. gulfensis* is longer and proportionately less inflated; (2) overall, it is more elongate; (3) while varying somewhat in shape, not as much as *S. fragilis* and never as irregular, suggesting a non-nestling habitat, (4) the right valve overlaps the left valve more extensively postero-ventrally; (5) the chondrophore in the left valve, while varying somewhat in shape, is normally smaller and projects more horizontally, and has a longer posterior buttress; the resilifer in the right valve is consequently more deeply recessed; (6) the cardinal tooth in the right valve is more conspicuous; (7) the posterior end is sometimes flared and is not extended by periostracum; and (8) the posterior adductor and the pallial sinus are positioned further from the posterior end.

In the Golfo de California, where their distributions overlap, specimens of *S. fragilis* and *S. gulfensis* smaller than 2 mm are difficult to differentiate. In such material, *S. fragilis* is most easily distinguished by its more rounded outline, more inflated posterior end, its more posteriorly positioned pallial sinus, and its proportionately larger chondrophore.

This new species differs from *S. sincera* Hanks and Packer, 1985, which inhabits soft bottoms in 30 to 63 m in northern New England, in being longer and more tapered posteriorly, having a narrower, less projecting chondrophore, having a thinner, almost transparent periostracum, and in attaining a larger size.

Etymology: The name *gulfensis* refers to the fact that the known distribution of this new species is chiefly restricted to the Gulf of California.

Sphenia hatcheri Pilsbry, 1899
(Figures 11–13, 21)

Sphenia hatcheri Pilsbry, 1899: 128, pl. 1, fig. 5, 6; Lamy, 1927: 181; Carcelles, 1950: 82, pl. 5, fig. 94; Carcelles and Williamson, 1951: 347; Castellanos, 1965: 173–175, pl. 1, figs. 1–5; Figueiras and Sicardi, 1970b: 22, pl. 7, fig. 103; Castellanos, 1970: 278–279, 348, pl. 25, figs. 9–11 [349]; Bernard, 1983: 58.

Sphenia subequalis Dall, 1908: 422–423; Lamy, 1927: 181–182; Carcelles, 1950: 82; Castellanos, 1965: 174 [as a synonym of *S. hatcheri*]; Bernard, 1983: 58 [as a synonym of *S. hatcheri*].

Description: Shell of moderate thickness, elongate; subequivalve; anterior end produced, rounded, width tapering gradually towards posterior end; posterior end

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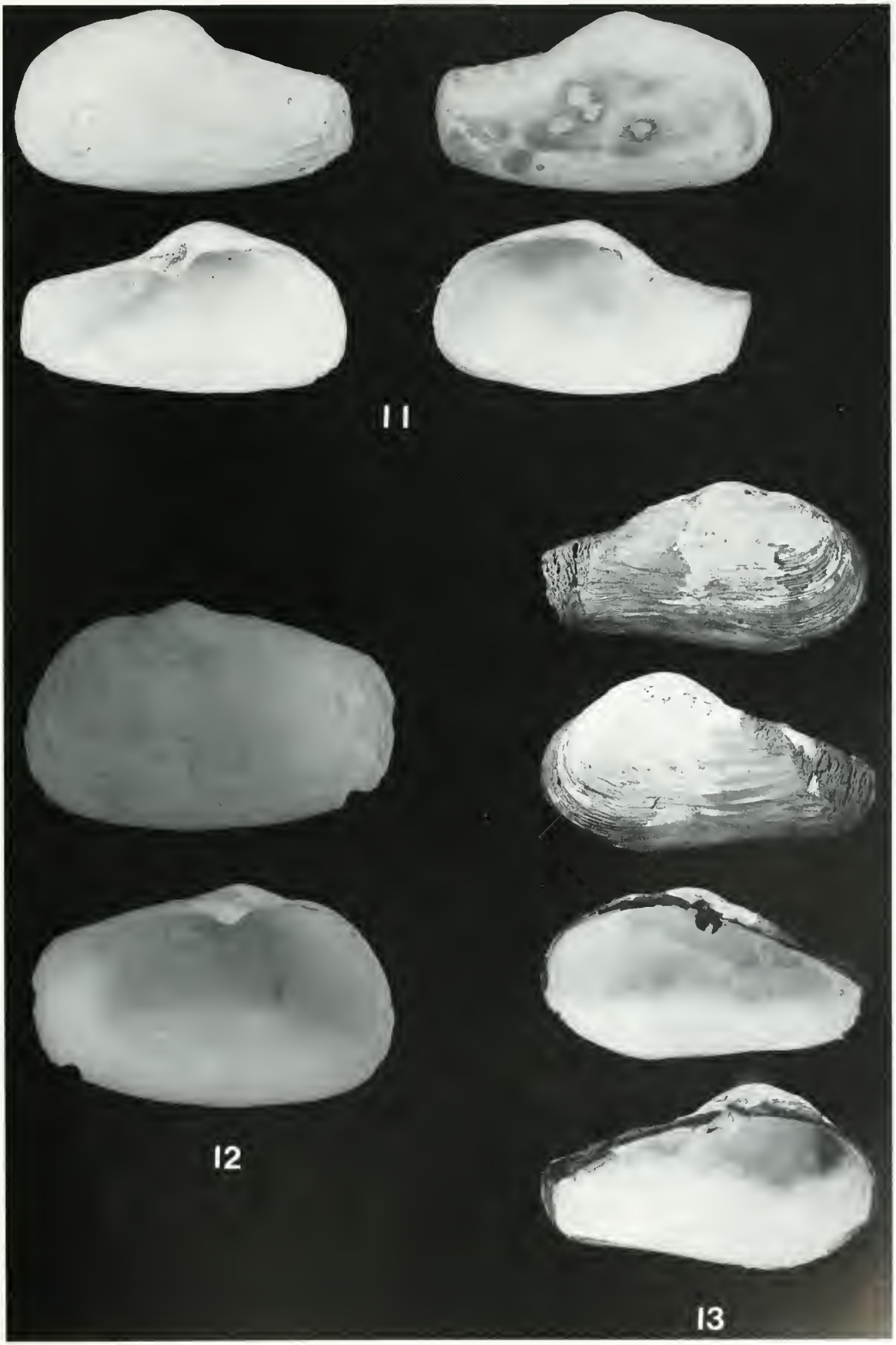
Figures 11–13. *Sphenia hatcheri*. **11.** Holotype; ANSP 18083, length = 17.2 mm. **12.** Holotype of *Sphenia subequalis*, left valve, USNM 110719, length = 6.9 mm. **13.** Specimen from Isla Chiloé, Chile, SBMNH 144635, length = 30.1 mm.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elongate, tapering, truncate posteriorly, extended by periostracum, scarcely gaping. External surface with fine to moderate commarginal ribs. Periostracum of moderate thickness, thicker on posterior slope, light tan, eroded in large specimens. Left valve with a large chondrophore, projecting as much ventrally as horizontally; anterior buttress wide; posterior buttress short; posterior ridge extending a little beyond ventral margin of chondrophore. Right valve with resilifer not very deeply recessed, with a conspicuous anterior cardinal tooth. Anterior adductor placed antero-ventrally. Posterior adductor and pallial sinus recessed from posterior margin. Pallial sinus of one broad and several smaller scars; pallial line a discontinuous series of small scars (Figure 21). Length to 30.1 mm (SBMNH 144635; Isla Chiloé, Chile).

Type material and localities:

S. hatcheri—ANSP 18083, holotype, pair; length, 17.2 mm; height, 9.2 mm; thickness, 7.3 mm (Figure 11). "Cape Fairweather" (Cabo Buen Tiempo), Santa Cruz Province, Argentina (51.5°S).

S. subequalis—USNM 110719, holotype, left valve; length, 6.9 mm; height, 4.3 mm; thickness, 1.3 mm (Figure 12). Seconda Angostura, eastern end of Estrecho de Magallanes, Magallanes Province, Chile (52.6°S, 70.2°W); *Albatross* stn. 2779; 20 fms. [37 m], on gravel.

Distribution: La Paloma, Rocha Department, Uruguay (34.6°S) (Figueiras and Sicardi, 1970b); Mar del Plata, Buenos Aires Province (38.0°S) (Castellanos, 1970: 279; MACN 10757, not seen); Puerto Madryn, Golfo Nuevo, Chubut Province (42.8°S) (ANSP 170466), and Cabo Domingo, Tierra del Fuego Province (53.7°S) (ANSP 236074), Argentina, in the Estrecho de Magallanes, at 52.6°S (USNM 110719), and north in the eastern Pacific to Isla Chiloé, Chiloé Province, Chile (approx. 43°S) (Figure 13) (SBMNH 144635). The only depth record available is that with the type specimen of *S. subequalis*, 37 m. The material that has been illustrated and that I have studied is of similar shape, suggesting that the species occurs in relatively soft substrata. Records from north of the Golfo Nuevo—the Uruguayan and Mar del Plata specimens cited above—probably represent sporadic larval settlement. Only a single eastern Pacific lot has thus far come to my attention, and I have been unable to discover what material Bernard (1983) relied upon for his eastern Pacific record of this species.

Discussion: The largest species of the genus, *S. hatcheri* is most similar to *S. luticola*. The former differs in having a thinner, more regular shell with a broader posterior end. The chondrophore in the left valve projects more toward the right valve, with the resilifer in the right valve more deeply recessed. The posterior ridge does not extend as far beyond the ventral edge of the chondrophore.

Sphenia luticola (Valenciennes, 1846)
(Figures 1b, 14–17, 22)

Corbula luticola Valenciennes, 1846: pl. 24, fig. 6, 6a; Carpenter, 1864: 543 (as *Sphenia*, and as a possible senior synonym of *S. fragilis*); E. A. Smith, 1893: 279; Lamy, 1927: 179–180 (as *Sphenia* and as senior synonym of *S. fragilis*, but under the latter heading); Hertlein and Grant, 1972: 321–322, pl. 56, figs. 21, 22 (as "cf. *luticola*"); Bernard, 1983: 58.

Sphenia pholadidea Dall, 1916a: 41, *nomen nudum*; 1916b: 415; Oldroyd, 1925: 201; Lamy, 1927: 181; Bernard, 1983: 58 (as a synonym of *S. luticola*)

Cuspidaria (Tropidomya) nana Oldroyd, 1918: 28; Oldroyd, 1924: 99, pl. 13, figs. 8, 9; J. T. Smith, 1978: 350; Bernard, 1983: 58 (as a synonym of *S. luticola*); Coan and Kellogg, 1990: 178.

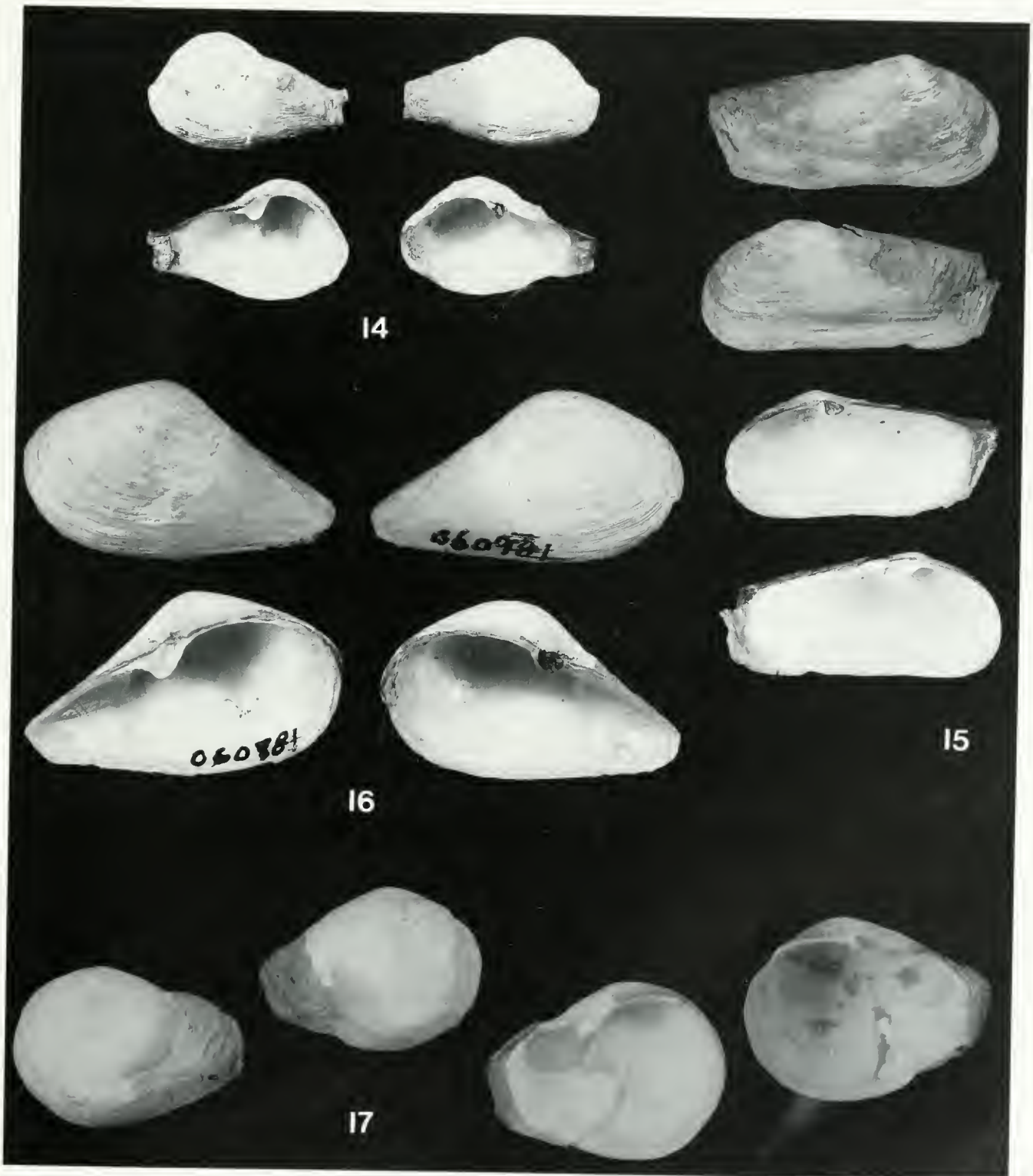
Sphenia globula Dall, 1919: 370–371; Oldroyd, 1925: 201; Lamy, 1927: 181; Schenck and Keen, 1940: 391, pl. 2, figs. 4–7; Schenck, 1945: 517, 519, pl. 67, figs. 5–8; Woodring and Bramlette, 1951: 66, 91; J. T. Smith, 1978: 340; Bernard, 1983: 58 (as a synonym of *S. luticola*).

Description: Shell relatively thick, highly variable in shape, from oval to elongate; right valve slightly more inflated than left; anterior end short, broadly rounded; tapering in thickness evenly from anterior to posterior ends; posterior end from short to somewhat produced, and from truncate to somewhat pointed, sometimes twisted in various directions depending on crevice or hole inhabited, generally extended by outer shell layer and periostracum, scarcely gaping. External surface with fine commarginal ribs; periostracum light to dark tan, frequently eroded in large specimens. Left valve with large, heavy chondrophore, projecting more ventrally than toward right valve; posterior and anterior buttresses of chondrophore short, thick; posterior ridge often projecting well beyond ventral margin of chondrophore. Right valve with large, heavy, rounded resilifer under beaks, not deeply recessed, and sometimes with slightly projecting anterior cardinal tooth. Anterior adductor scar large, positioned ventrally. Posterior adductor scar and pallial sinus near posterior end. Pallial sinus of two relatively broad, elongate scars, and generally also with one or two smaller scars; pallial line a series of small, discontinuous scars (figure 22). Length to 20.6 mm (paratype of *C. nana*).

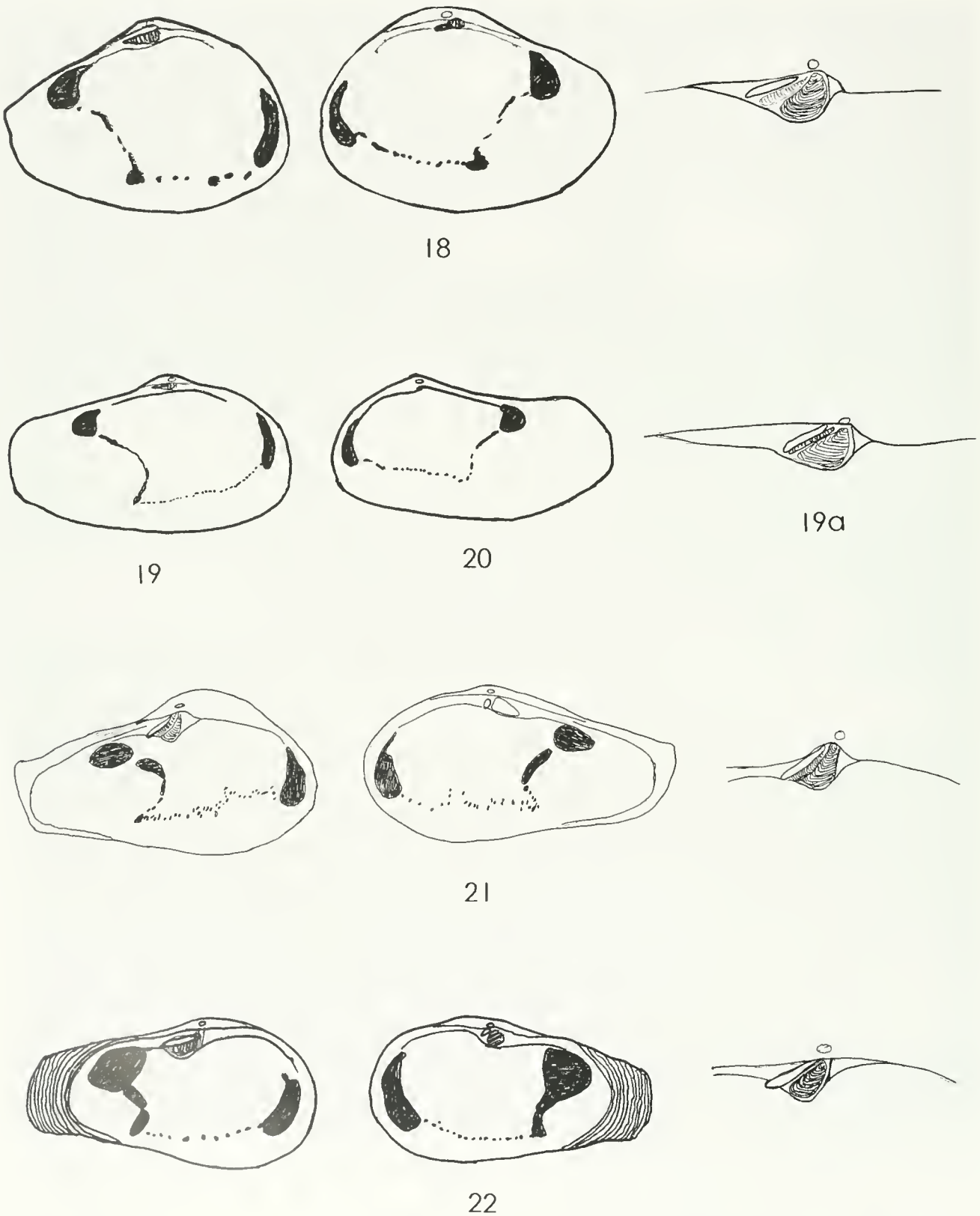
Type material and localities:

C. luticola—MNHN, lectotype herein designated, the larger of two pairs, likely that figured by Valenciennes (1846: pl. 24, fig. 6a) as an opened specimen; length, 10.7 mm; height, 6.3 mm; thickness, 6.0 mm (figure 14). Paralectotype, pair, perhaps that figured by Valenciennes (1846: pl. 24, fig. 6) as a closed pair in situ in a rock crevice; length, 9.3 mm. Locality not given in original account. The label says "Californie," to which someone has added "Mazatlán." The latter is undoubtedly incorrect, and the locality is here restricted to Monterey Bay, Monterey County, California (36.7°N), from where other of Valenciennes' material of bivalves boring or nestling in dredged rocks seems to have come.

S. pholadidea—USNM 2581, holotype, pair; length, 13.1 mm; height, 6.0 mm; thickness, 5.1 mm (Figure 15). Santa Barbara, Santa Barbara County, California (34.4°N); William Rich.



Figures 14–17. *Sphenia luticola*. **14.** Lectotype of *Corbula luticola*, MNHN, length = 10.7 mm. **15.** Holotype of *Sphenia pholadidea*, USNM 2581, length = 13.1 mm. **16.** Holotype of *Cuspidaria nana*, CAS 060981, length = 19.4 mm. **17.** Lectotype of *Sphenia globula*, USNM 218977, length = 12.8 mm.



Figures 18–22. Comparative pallial lines, muscle scars and hinges. **18.** *Sphenia fragilis*, SBMNH 144630, Puerto Peñasco, Sonora, Mexico, length = 9.1 mm. **19, 20.** *Sphenia gulfensis* new species. **19.** Holotype, SBMNH 144627, left valve, length, 11.8 mm. **20.** Paratype, SBMNH 144628, right valve, length = 10.6 mm. **21.** *Sphenia hatcheri*, SBMNH 144635, Isla Chiloé, Chile, length = 30.1 mm. **22.** *Sphenia luticola*, LACM 60–22, Monterey, California, 18 m, length = 14.1 mm.

C. nana—CAS 060981, holotype, pair; length, 19.4 mm; height, 11.1 mm; thickness, 10.1 mm (Figure 16). AMNH 58306, paratype, 20.6 mm. Monterey Bay, Monterey County, California (36.7°N).

S. globula—USNM 218977, lectotype herein designated, open pair; length, 12.8 mm; height, 8.7 mm; thickness, 8.4 mm, the only specimen cited in the original account (Figure 17). CAS 064102, open pair, paralectotype; length, 14.5 mm. CAS 085834, closed pair, paralectotype; length, 9.7 mm. Bolinas Bay, Marin County, California (37.9°N); Henry Hemphill. The last specimen was figured by Schenck and Keen (1940) and Schenck (1945) and may also be the Bolinas specimen of *Cuspidaria nana* referred to by Oldroyd (1918).

Distribution: West of Destruction Island, Jefferson County, Washington (47.7°N) (SBMNH 140087), south to San Diego, San Diego County, California (32.8°N) (USNM 322064, 322065), from 15 to 155 m (mean, 50 m; n = 15), nestling in holes in rock and shell. I have seen 34 Recent lots. This species has also been recorded in the Pliocene Foxen Mudstone of Santa Barbara County (Woodring and Bramlette, 1951: 66, 91, as *S. globula*) and San Diego Formation of San Diego County (Hertlein and Grant, 1972: 321–322, pl. 56, figs. 21, 22, as "cf. *luticola*"), California.

Discussion: The type specimens of this species and its synonyms demonstrate the potential of species of *Sphenia* to assume a variety of shapes. Nestling in pre-established cavities in subtidal rocks, the shell conforms to the shape of the available space in the same manner as the European Miocene *S. anatina* discussed by Baluk and Radwański (1979). The lectotype of *Corbula luticola* and the holotype of *Cuspidaria nana* are inflated and acuminate. The holotype of *Sphenia pholadidea* is flattened and truncate posteriorly, and the lectotype of *S. globula* is oval and inflated.

A small specimen (CAS 111000; Monterey, California; length, 5.8 mm) is regular in outline and only somewhat longer posteriorly. It is similar to juvenile *Mya*, but is easily distinguished by its shallow pallial sinus composed of broad pallial scars, as well as by features of its chondrophore, such as those outlined by Hanks and Packer (1985: 324) for their new species of *Sphenia*. In this small Monterey specimen, the chondrophore projects more horizontally and the resilifer in the left valve is more deeply recessed than those of large specimens, demonstrating the morphological change with growth.

Sphenia luticola and *S. fragilis* overlap in southern California. The former can be distinguished by its thicker shell, more ventrally directed chondrophore, with a larger, often projecting posterior ridge, and a pallial line formed by larger scars. It also occurs offshore and attains a larger size.

Of the eastern Pacific taxa, *S. luticola* is the most similar to the type species of the genus, *S. binghami*, which has a more regularly quadrate shape, with a broadly truncate posterior end, and its chondrophore is thinner, more horizontal, and does not have a projecting posterior ridge (USNM 171240 [lectotype], 171245, 337253). Its pallial sinus is composed of narrower scars, and attains only about 10 mm.

OTHER TAXA

Several fossil taxa of *Sphenia* have been named in North and Central America. While it is beyond the scope of the present paper to analyze their relationships, I list them here to facilitate access to this literature.

Sphenia senterfeiti Gardner (1936: 45, pl. 8, figs. 2–4), described from the Miocene Oak Grove Formation of the Alum Bluff Group of Florida, has an oblique outline, a broadly flared posterior end, and a relatively small, horizontal chondrophore [USNM 372905]. *Sphenia dubia* (Lea, 1843: 2) [originally as *Mya dubia*] from the Pliocene Yorktown Formation of Virginia is relatively thick shelled, variable in shape, but generally short and oval, and it has an especially large chondrophore in the left valve and resilifer in the right; *Mya reflexa* Lea (1843: 2) is regarded as a synonym (Campbell, 1993: 47, 213, fig. 187, 187a) [see also Lea, 1845: 236–237, pl. 34, figs. 9, 10] [ANSP 1588, USNM 403361, SBMNH 144632]. *Sphenia attenuata* Dall (1898: 860, pl. 35, fig. 9) [USNM 107806], from the Plio-Pleistocene Caloosahatchee Formation of Florida, is very similar to *S. dubia* and is perhaps a synonym of it.

Sphenia wallacei Dall (1912: 3), described from the late Pleistocene of Panama, seems to have been overlooked since it was proposed. The type material [USNM 214354] consists of a large right valve (length, 10.3 mm), a medium-sized left valve (length, 9.1 mm), and a small left valve (length, 3.7 mm). The right valve, which would be the logical candidate for an eventual lectotype designation, is oval and inflated and seems to be same thing as the later-named *S. tumida* Lewis (1968: 26–30, pl. 1, figs. 1–4) [USNM 645663–645667] from the Pleistocene of Florida. The larger left valve in the type lot of *S. wallacei* is elongate and may be *S. fragilis*; the other left valve is too small to identify. *Sphenia tumida* was reported from a Texas beach, although it was thought to have possibly been a fossil (Odé and Speers, 1971: 71; Odé, 1971: 74–75). However, *Sphenia tumida* has been reported and figured as living on the coast of Yucatan, Mexico (Vokes and Vokes, 1983: 44, pl. 48, fig. 16). Thus, there may be a second living species of *Sphenia* in the western Atlantic, which should be called *S. wallacei*.

EXCLUDED TAXA

Sphenia bilirata Gabb (1861: 369) was described from Santa Barbara, California, presumably from the Tertiary, as is implied by the paper's title ("Descriptions of new species of American Tertiary Fossils and a new Carboniferous Cephalopod from Texas"). *Sphenia bilirata* was not figured, and the type material has never been located. There must have been more than one original specimen, because the diameter was said to be "variable." As has been noted by previous workers (Carpenter, 1864: 632 [1872: 118]; Lamy, 1927: 177), the description close-

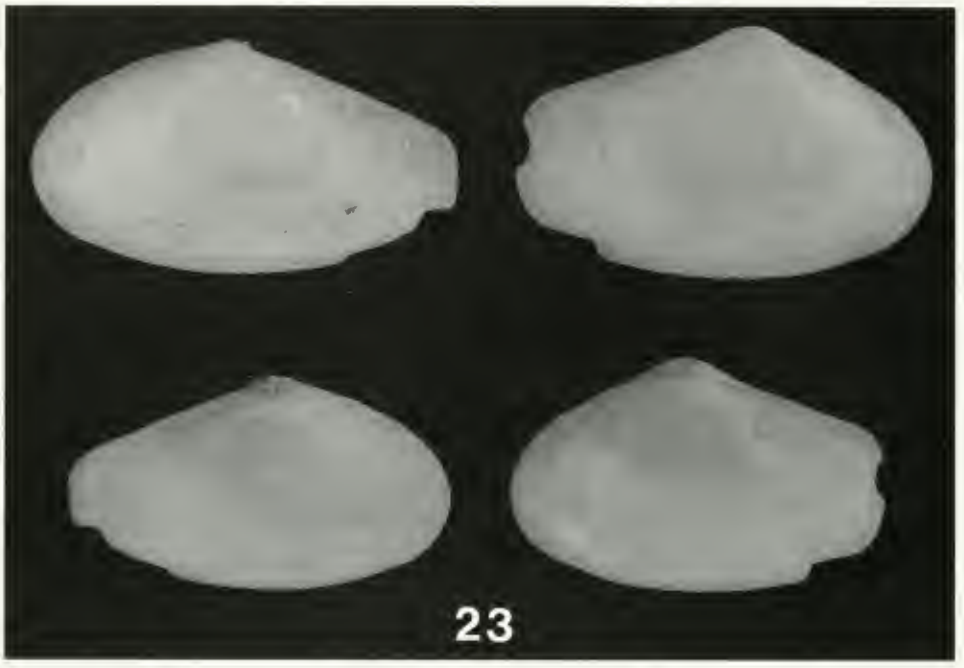


Figure 23. *Mya ?arenaria* Linnaeus, 1758. Holotype of *Sphenia ovoidea*. USNM 4552, length, 7.5 mm.

ly matches small *Hiatella arctica* (Linnaeus, 1758). However, *Hiatella* has not been recorded from the Santa Barbara Formation (Arnold, 1907: 32; Dibblee, 1966: 58), the outcrop of which at Bathhouse Beach is the most likely locality for the rest of the Santa Barbara taxa described in Gabb's paper[4]. Additional study of the Santa Barbara Formation is needed, because its fauna remains poorly documented. It is more likely that *S. bilirata* came from the Recent fauna, because, while it is recorded by Gabb simply as "Santa Barbara Cal.," each of the other Santa Barbara fossil taxa also adds "Miocene" or "Miocene?" (The Santa Barbara Formation is now regarded as being of early Pleistocene age.)

Sphenia californica Conrad (1837: 234, pl. 17, fig. 11) is the original combination for *Cryptomya californica* (Conrad, 1837) (Keen, 1966: 171).

Sphenia? meganosensis Clark and Woodford (1927: 106, 134, pl. 18, figs. 15, 16), from the lower middle Eocene Meganos Formation of central California, is based on two closed specimens [UCMP 31326, 31327] said to resemble material of *Sphenia* from the Eocene of the Paris Basin. No additional specimens of this species have been recorded, nor has the genus been reported in any other strata earlier than the Pliocene in western North America. Until more material becomes available and a hinge exposed, one cannot be certain that this material represents *Sphenia*.

Sphenia ovoidea Carpenter (1864: 602, 637 [1872: 88, 123], 1865: 54) was described from a single specimen, paired valves obtained in Puget Sound from a fish stomach in the 1860s. (*Sphenia ovalis* Carpenter, 1864: 682 [1872: 168], is a typographical error for *ovoidea* in the same work.) Although previous workers have listed it as a *Sphenia*, examination of the holotype [USNM 4552; length, 7.5 mm; height, 4.5 mm; thickness, 2.8 mm] (Figure 23)[5], which was well figured by Palmer (1958: 116, 340, pl. 15, figs. 7–10), confirms Carpenter's "mantle bend large" (i.e., a large pallial sinus), demonstrating that it is a juvenile *Mya*, not a *Sphenia*. Juvenile *Mya* are most easily distinguished from *Sphenia* by their larger, continuous pallial sinuses. This specimen appears to be *Mya arenaria* Linnaeus (1758: 670); it presents a quandary because this species, having become extinct in the Pacific Northwest by the Pleistocene (Carlton, 1979: 518–543, 1992: 495), was first recorded in the 1880s, when it became reestablished through introduction from Atlantic populations with imports of *Crassostrea virginica* (Gmelin, 1791). The only *Mya* thought to have been present in the 1860s is *Mya truncata* Linnaeus (1758:

[4] Another Santa Barbara bivalve described in Gabb's paper, *Cardita monilicosta* (p. 371), has been subsequently recorded from this formation. A third Santa Barbara bivalve, *Venus rhysomia* (pp. 369–370), which has been regarded as a synonym of *Nutricola tantilla* (Gould, 1853:406) (Carpenter, 1864:632; S. Gray, 1982:108–109, as *Transennella*; generic allocation: Coan and Scott, 1997:14, 25), has not been recorded from the Santa Barbara Formation, but *N. barbarensis* (Arnold, 1907: 440–441, pl. 58, fig. 3, as *Psephidia*) is so recorded, and I thus suspect that *V. rhysomia* is a senior synonym of Arnold's taxon instead. The two gastropods described from the same station have subsequently been recorded there, both now regarded as junior synonyms of other taxa.

[5] A broken valve in a separate capsule with the holotype is an unrelated species, most likely a lyonsiid, mixed into the lot between the time of Carpenter and that of Palmer.

Figure 24. *Sphenia fragilis.* Lectotype of *Corbula iheringiana* Pilsbry, 1897; ANSP 70541, length, 9.0 mm.

670)[6], but small specimens of that species are very different from those of *arenaria.* It is possible that: (1) the specimen might not actually have come from Puget Sound, although all the other material collected there by C. B. R. Kennerley of the Northwest Boundary Survey has proven to authentic; or that (2) *Mya arenaria* was actually present in Puget Sound 20 years earlier than previously thought as a result of introduction with oysters or ship fouling (J. T. Carlton, e-mail, 19 November 1997).

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[6] The second species of *Sphenia* described by Turton (1822) along with the genus and *S. binghami*, its type species, was *S. swainsoni* (pp. 37–38, pl. 2, fig. 3, pl. 19, fig. 2). It was regarded as having been based on a juvenile *Mya truncata* by MacNeil (1965:38).

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Two new species of the genus *Chicoreus* (*Siratus*) (Gastropoda: Muricidae) from the western Atlantic.

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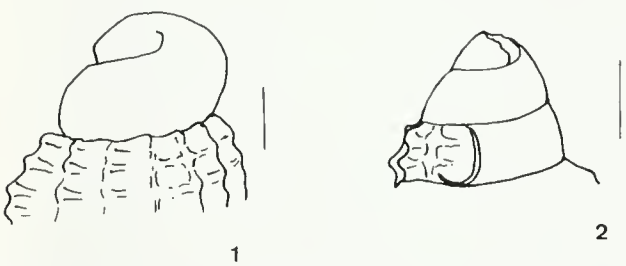
ABSTRACT

Two new species of the family Muricidae are described. *Chicoreus (Siratus) colellai*, from off Veracruz, eastern Mexico, is compared with *C. (S.) articulatus* (Reeve, 1845), and differs from this latter species in many aspects. *C. (S.) caudacurta*, from off Puerto Rico, is somewhat similar to *C. (S.) beauii* (Fischer & Bernardi, 1857), but differs in having a broad, paucispiral protoconch, a higher spire, and a shorter siphonal canal.

Key words: Gastropoda, Muricidae, *Chicoreus (Siratus)*, western Atlantic, Mexico, Puerto Rico, new species.

INTRODUCTION

At least 19 Recent species of *Chicoreus* (*Siratus*) are known, of which only 2, *C. (S.) alabaster* (Reeve, 1845), and *C. (S.) pliciferoides* Kuroda, 1942, occur in the Indo-West Pacific region (Houart, 1992), and 17 in the western Atlantic. The western Atlantic species have been reviewed and illustrated in several works (Fair, 1976; Radwin & D'Attilio, 1976; Rios, 1985; Vokes, 1963, 1980, 1990, 1991). Additional names have been proposed, but are synonymized under the 17 taxa herein recognized. The Recent western Atlantic species of *Siratus* are listed in Table 1.



Figures 1, 2. Protoconchs. **1.** *Chicoreus (Siratus) caudacurta* new species, off Veracruz, dredged in 400–500 m, paratype R. Houart Collection. **2.** *C. (S.) beauii* (Fischer & Bernardi, 1857), Florida, off Egmont Key, 73 m, R. Houart Collection. Scale bar = 0.5 mm.

Recently, José Coltro (São Paulo, Brazil) sent me several lots of *Chicoreus (Siratus)* dredged from deep water in different regions of the Caribbean Sea. Within these lots, I immediately noticed the presence of unusual forms. Some of these were identified as representing extremes of variation of known species, but two remained unidentified. One, *C. (S.) colellai* new species, differs from all Recent or fossil species. The other, *C. (S.) caudacurta* new species resembles a small, spineless *C. beauii*, but the protoconch whorls are distinct in the two taxa. Abbreviations and text conventions are: dd, empty shell; MORG, Musen Oceanográfico "Prof. Eliézer de C. Rios", Fundação Universidade do Rio Grande, Rio Grande do Sul, Brazil.

SYSTEMATICS

Family Muricidae Rafinesque, 1815
Subfamily Muricinae Rafinesque, 1815
Genus *Chicoreus* Montfort, 1810

Type species: *Murex ramosus* Linnaeus, 1758; Recent, Indo-West Pacific, by original designation.

Subgenus *Siratus* Jousseaume, 1880

Type species: *Purpura Sirat* "Adanson" Jousseaume, 1880 (= *Murex senegalensis* Gmelin, 1791), Recent, Brazil, by original designation.

Chicoreus (Siratus) colellai new species
(Figures 3–5)

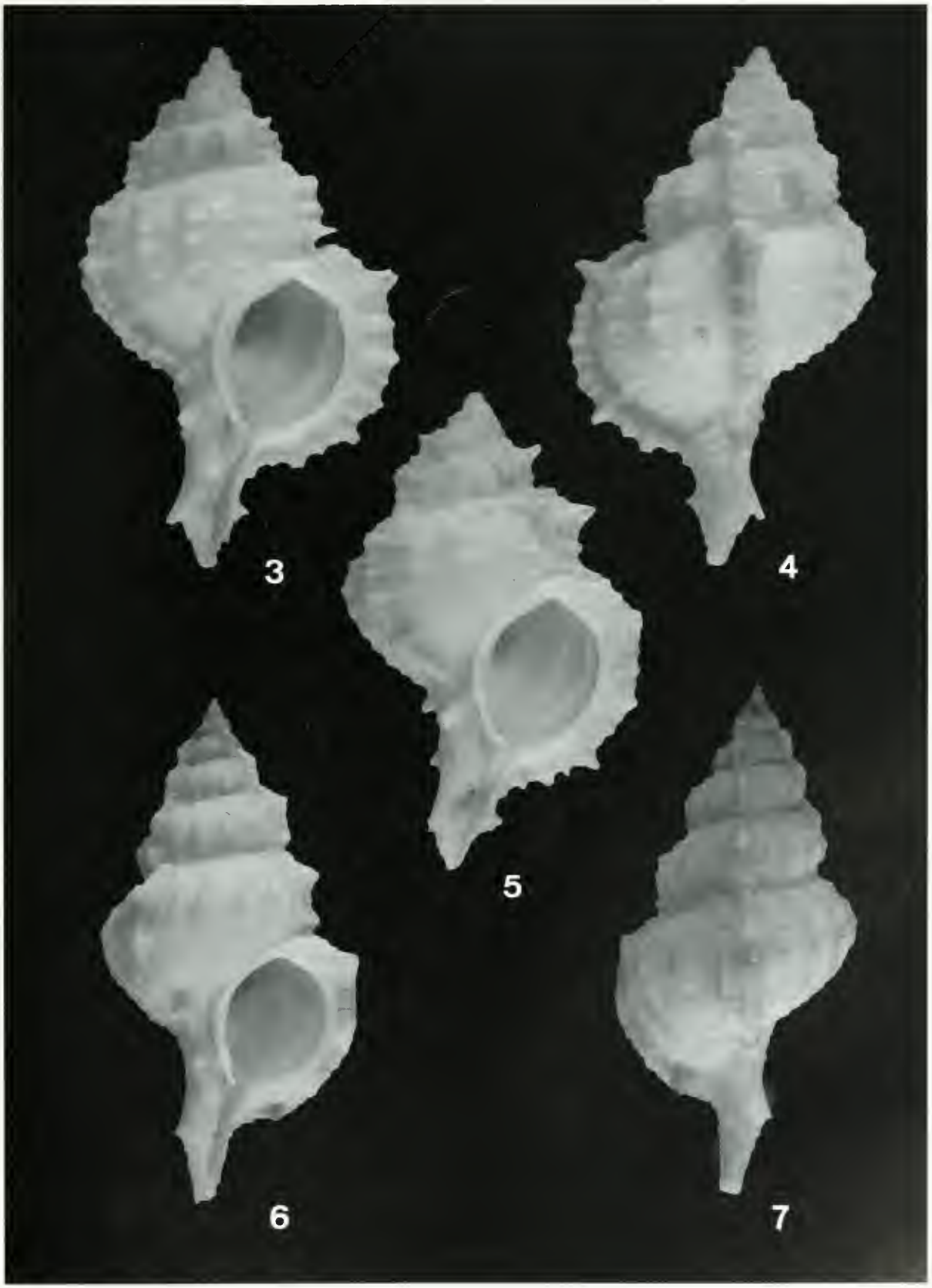
Description: Shell medium sized for the subgenus, up to 47 mm in length at maturity (holotype), weakly spinose, nodose, lightly built. Spire high, up to 6 broad, convex, weakly spinose teleoconch whorls. Suture impressed. Protoconch unknown (broken).

Axial sculpture of teleoconch consisting of 3 low, narrow, rounded, weakly spinose varices from first to last whorl. Other axial sculpture of low, narrow, rounded

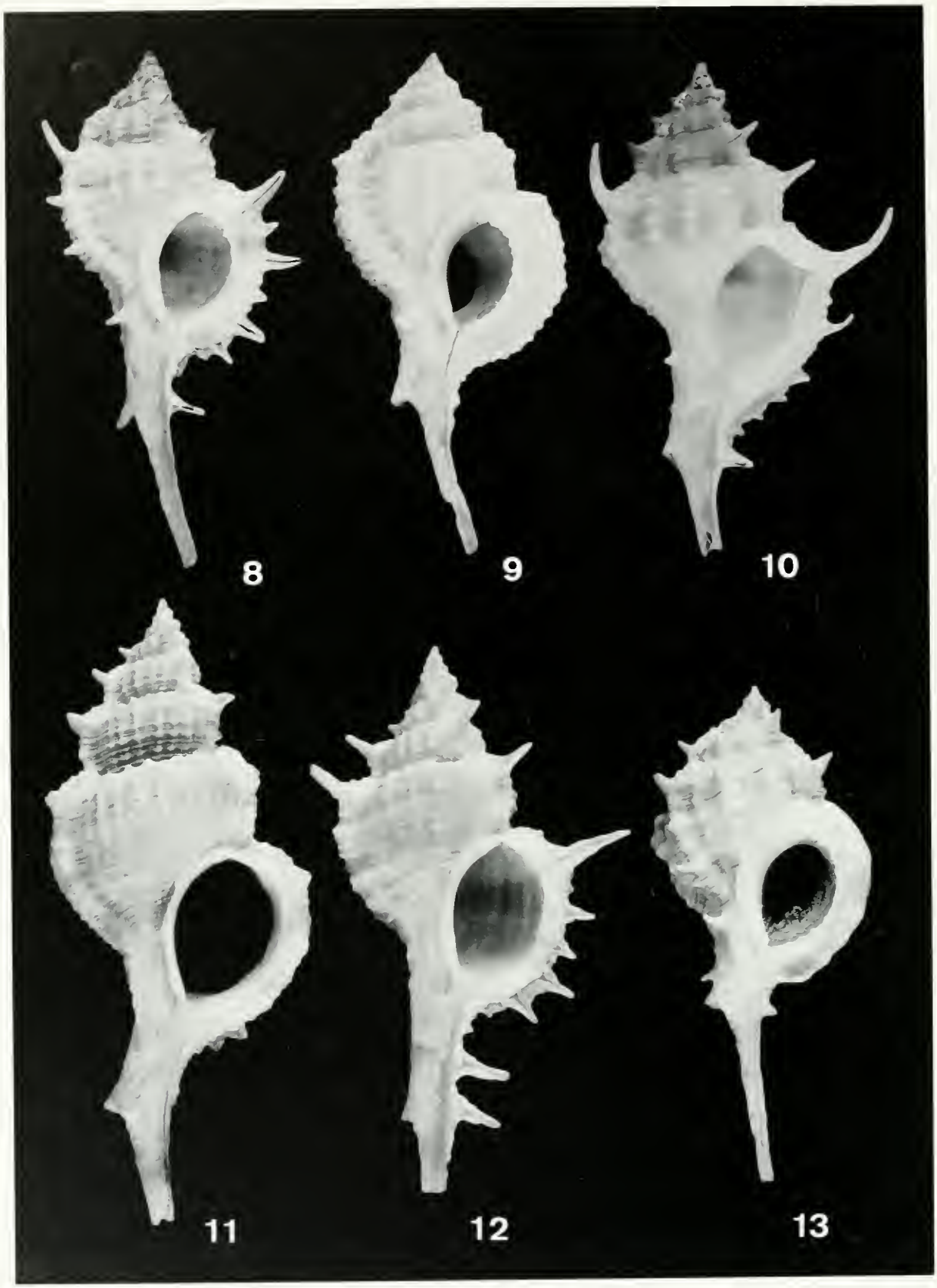
Table 1. Geographic and bathymetric range of western Atlantic species of *Siratus* species (species names printed in boldface are considered as valid):

Name of species	Geographical distribution	Bathymetric range (live specimens)
Chicoreus* (*Siratus*) *aguayoi (Clench & Pérez Farfante, 1945)	Bahamas to Cuba	338–521 m
C.* (*S.*) *articulatus (Reeve, 1845) *Murex nodatus* Reeve, 1845 (not Gmelin, 1791) *Murex gundlachi* Dunker, 1883 *Murex finlayi* Clench, 1955	E Florida to Ceará, Brazil	16–400 m
C.* (*S.*) *beauii (Fischer & Bernardi, 1857) *Murex percoides* Löbbecke, 1879 *Murex branchi* Clench, 1953	Florida to Uruguay	73–463 m
C.* (*S.*) *cailletti (Petit, 1856) *Murex similis* Sowerby, 1841 (not Schröter, 1805) *Murex kugleri* Clench & Pérez Farfante, 1945 (new name for *M. similis* Sowerby, 1841, not Schröter)	Florida to Honduras, Colombia, and Barbados	46–400 m
C.* (*S.*) *carolynae Vokes, 1990	Bahia, Brazil	Unknown (probably 10–40 m, R. Houart collection)
C.* (*S.*) *ciboney (Clench & Pérez Farfante, 1945) *Murex trilineatus* Reeve, 1845 (not Sowerby, 1813) *Chicoreus reevei* Vokes, 1965 (new name for *M. trilineatus* Reeve, 1845, not Sowerby) *Murex yumurinus* Sarasúa & Espinosa, 1978	Cuba to Lesser Antilles	110–455 m
C.* (*S.*) *coltrorum Vokes, 1990	Northern Brazil	2–100 m
C.* (*S.*) *consuela (Verrill, 1950) *Murex pulcher* A. Adams, 1853 (not Sowerby, 1813) *Murex pulcher* var. *consuela* Verrill, 1950	Gulf of Mexico to Lesser Antilles	14–110 m
C.* (*S.*) *formosus (Sowerby, 1841)	Jamaica and Cuba	20–100 m
C.* (*S.*) *motacilla (Gmelin, 1791) *Murex briskasii* Verrill, 1953	Lesser Antilles	170 m
C.* (*S.*) *perelegans Vokes, 1965 *Murex elegans* Beck in Sowerby, 1841 (not Donovan, 1804) *Chicoreus perelegans* Vokes, 1965 (new name for *M. elegans* Beck in Sowerby, 1841, not Wood, 1828)	Haiti to Barbados	100–120 m
C.* (*S.*) *senegalensis (Gmelin, 1791) *Murex costatus* Gmelin, 1791 *Murex brasiliensis* Sowerby, 1834 *Purpura sirat* d'Orbigny, 1841	Surinam and Brazil (Espírito Santo to Santa Catarina)	2–15 m
C.* (*S.*) *springeri (Bullis, 1964)	Northern South America	20
C.* (*S.*) *tenuivaricosus (Dautzenberg, 1927) *Murex calcar* Kiener, 1843 (not Scacchi, 1835) *Murex tenuivaricosus* Dautzenberg, 1927 (new name for *M calcar* Kiener, not Sowerby) *Chicoreus carioca* Vokes, 1968 (new name for *calcar* Kiener, 1842)	Brazil (Espírito Santo to Santa Catarina)	2–40 m
C.* (*S.*) *thompsoni (Bullis, 1964)	Surinam, Venezuela, Brazil (Amapa to Bahia)	18–40 m
C.* (*S.*) *colellai new species	Off Puerto Rico	Unknown (914–1097 m for empty shells)
C.* (*S.*) *caulacurta new species	Mexico, off Veracruz	Unknown (400–500 m for empty shells)

intervarical ribs: 2 from first to third whorl; 2 or 3 on fourth; 3 on fifth; 3, occasionally with low fourth one, on last whorl. Spiral sculpture of low, narrow, smooth, primary, secondary, and tertiary cords. Spire whorls with 2 or 3 primary cords, and one secondary cord in each interspace; penultimate with 4 primary cords, and one secondary cord in each interspace; last whorl with 5 primary cords that interconnect strongest varical spines, with secondary and tertiary cords in each interspace. Cords more obvious on axial varices. Shoulder of last whorl with 4 or 5 spiral cords. Aperture large, broad, rounded. Columellar lip narrow, with 3 weak knobs abapically. Rim partially erect, adherent at adapical extremity. Anal notch broad, deep. Outer lip weakly erect,



Figures 3–7. New species of *Chicoreus*. **3–5.** *C. (Siratus) colellai*, type locality (off Puerto Rico, 914–1097 m). **3**, **4.** Holotype MORG 39519, 47 mm. **5.** Paratype, R. Houart Collection, 42.9 mm. **6**, **7.** *C. (S.) caudacurta* Holotype MORG 39520, type locality (off Veracruz, 400–500 m), 45.8 mm.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smooth within. Siphonal canal short, but partially broken in all specimens, weakly angulate, open, with 1 or 2 short spines adaperturally, and 2 or 3 spiral cords. Shell white, with presence of brown blotches on 2 or 3 primary cords. Operculum and radula unknown.

Type material: Holotype, MORG 39519, dredged (dd); paratypes (from type locality), R. Houart collection (Ezemaal, Belgium), 1 paratype; J. & M. Coltro collection (São Paulo, Brazil), 1 paratype.

Type locality: Off Puerto Rico, 914–1097 m.

Etymology: Named in honor of Mr. Julio Colella, one of the founding members of the two Brazilian shell-related organizations, "Sociedade Brasileira de Malacologia" and "Conquiliologistas do Brasil".

Discussion: *C. colellai* new species differs from all other species of *Chicoreus (Siratus)* in having rounded, broad, last teleoconch whorl, rounded aperture, narrow varices, and short siphonal canal. *C. colellai* is most closely related to *C. (S.) articulatus* (Figs 8–10), a species with very variable shell, however, *C. colellai* differs in having more widely spaced, narrower, axial ribs, narrower varices, broader, more rounded aperture, and narrower (relative to the shell width) siphonal canal.

Chicoreus (Siratus) caudacurta new species
(Figures 1, 6, 7)

Description: Shell medium sized for subgenus, up to 50 mm in length at maturity, lanceolate, weakly spinose, lightly built. Spire very high with 1.45 protoconch whorls, and up to 7 convex, low, weakly spinose teleoconch whorls. Suture impressed. Protoconch large, broad, irregularly shaped, smooth. Terminal varix unknown (eroded). Axial sculpture of teleoconch consisting of low, narrow, weakly spinose varices. Other axial sculpture of weakly nodose, intervarical ribs. Shoulder spine longest. First whorl with 15 ribs, second with 14, third to last whorl with 3 varices and 3 or 4 intervarical ribs. Spiral sculpture of primary, and secondary, low cords and threads. First to third whorl with 4 primary cords and 1 or 2 secondary cords; fourth and fifth with 6–8 cords and threads; last whorl with 13–15 cords and threads; shoulder with 3 or 4 cords. Aperture large, rounded. Columellar lip narrow, with 2 or 3 weak, low knobs abapically. Rim partially erect, adherent at adapical extremity. Anal notch narrow, deep. Outer lip weakly erect, smooth within. Siphonal canal short in examined specimens, narrow, open, weakly angulate, with 3 or 4 low, spiral cords, and one short spine adaperturally. Shell ivory-white or creamy-white, with brown tinge on some spiral cords, more apparent on two cords abapically of shoulder, two on periphery, and two above siphonal canal. Aperture white. Operculum and radula unknown.

Type material: Holotype MORG 39520, dredged (dd); R. Houart collection, 1 paratype, from type locality.

Type locality: off Veracruz, eastern Mexico, 400–500 m.

Etymology: Latin for "short tail", alluding to its short siphonal canal.

Discussion: *Chicoreus (Siratus) caudacurta* somewhat resembles *C. (S.) beauii* (Figures 2, 11, 12) from which it differs in having apparently different larval development. *Chicoreus (S.) caudacurta* has large, irregularly shaped, broad protoconch of 1.45 whorls (Figure 1), which suggest non-planktotrophic and possibly intracapsular development, while *C. (S.) beauii* has conical protoconch of 3+ whorls and small embryonic whorl (Figure 2), which suggests planctotrophic larval development. *Chicoreus (S.) caudacurta* also has a higher spire relative to the height of the aperture, and the length of the siphonal canal. *Chicoreus (S.) caudacurta* differs from *C. (S.) cailleti* (Petit de la Saussaye, 1856) (Figure 13) by higher spire, shorter siphonal canal, broader aperture, and protoconch twice as large. The new species differs from the "form" *C. kugleri* (Clench and Pérez-Farfante, 1945) in having shallower, more numerous, narrower spiral threads and cords, higher spire relative to the height of the aperture and the length of the siphonal canal, and a protoconch twice as large.

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Figures 8–13. Other species of *Chicoreus*. **8–10.** *C. (Siratus) articulatus* (Reeve, 1845). **8.** Off Haiti, R. Houart Collection, 52.1 mm. **9.** Off Honduras, 200–300 m, R. Houart Collection, 50.4 mm. **10.** Off Paramaribo, Surinam, 300–400 m, R. Houart Collection, 32.2 mm. **11, 12.** *C. (S.) beauii* (Fischer & Bernardi, 1857). **11.** Bahia de Campeche, off Veracruz, eastern Mexico, 200–300 m, R. Houart Collection, 108.2 mm. **12.** Off Egmont Key, Florida, 73 m, R. Houart Collection, 56.5 mm. **13.** *Chicoreus (Siratus) cailleti* (Petit de la Saussaye, 1856). St. James, Barbados, 94 m, R. Houart Collection, 52.7 mm.

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Harald A. Rehder (1907–1996): biographical sketch and malacological contributions

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Dr. Harald Alfred Rehder, Zoologist Emeritus at the National Museum of Natural History of the Smithsonian Institution, and a leading authority on the systematics and biogeography of the molluscan fauna of Polynesia, died on November 10, 1996, of cardiac arrest. An eminent scholar, he enjoyed a long and distinguished career, and was highly respected by the international malacological community, as well as by the many amateur naturalists interested in mollusks.

Harald Rehder was born on June 5, 1905, in Boston, Massachusetts, the son of a botanist and curator at Harvard University's Arnold Arboretum. He grew up in the Boston suburb of Jamaica Plain, were he attended Roxbury Latin School. With the encouragement of his father and of Charles W. Johnson of the Boston Society of Natural History, his interest in natural history gradually became focused on mollusks. After earning a Bachelor of Arts degree in Chemistry from Bowdoin College in 1929, he entered Harvard University as William J. Clench's first graduate student in Malacology.

Prior to completing his degree at Harvard, he obtained a position as a Senior Science Aide to Dr. Paul Bartsch in the Division of Mollusks at the National Museum of Natural History in 1932. Harald Rehder received his Master of Arts degree in Malacology from Harvard University in 1933, and his Ph. D. in Malacology from George Washington University (Washington, DC) in 1934. His dissertation, "A contribution to our knowledge of the genus *Succinea* in North America" was completed under the guidance of Dr. Bartsch. After receiving his doctoral degree, he became an Assistant Curator in the Division of Mollusks in 1934, an Associate Curator in 1942, and succeeded Paul Bartsch as Curator in 1946. Dr. Rehder was named Senior Zoologist in 1965, and held this position until his retirement in June 1976. He continued, as Zoologist Emeritus, to publish popular books and research papers on mollusks until his death.

Dr. Rehder devoted an extraordinary amount of time and effort throughout his career to the care and curation of the National Collection of Mollusks. During the Second World War, Dr. Rehder and Dr. J. P. E. Morrison, also of the Division of Mollusks, completed the daunting task of identifying, documenting, and segregating thousands of type specimens of mollusks in preparation for removal from the general collections to the caverns in Luray, Virginia, for safekeeping. Upon their return to the National Museum after the war, these collections remained segregated as the type collection. Dr. Rehder oversaw the move of the collections from the central portion of the museum to the newly constructed research wing in the 1960s, and continued to curate countless new acquisitions well into his retirement.

Dr. Rehder began his career working primarily on the systematics of land and freshwater gastropods, but soon expanded his work to include marine faunas. He took part in expeditions to the Caribbean early in his career, but his major research interest, the study of the molluscan faunas of the Central and South Pacific, developed during his participation in the Smithsonian-Bredin Expedition to French Polynesia in 1957. He was a member of the Pacific Science Board's expeditions to the Marshall Islands in 1960, and led additional expeditions to the South Pacific in 1963, 1964, 1967, 1969, 1970, and 1973, supported by grants from the National Geographic Society, The National Science Foundation, and by private donors. Dr. Rehder conducted field work at more than fifty islands and atolls during his career. The National Collection was enriched by over thirteen thousand lots and nearly one hundred thousand specimens that were collected during these expeditions.

Dr. Rehder served as advisor to Helen L. Hayes, Joseph C. Britton, and George Radwin, who completed their doctoral degrees in malacology at George Washington University between 1968 and 1972.

Harald Rehder was the last surviving founding member of the American Malacological Union (now the American Malacological Society). He served as President of this organization in 1940–41, was elected as Honorary Life Member in 1978 and Honorary Life President in 1985.

Dr. Rehder was a Fellow of the American Association for the Advancement of Science and the California Academy of Science, and a member of numerous professional societies, among them the Washington Academy of Sciences, the Biological Society of Washington, the Malacological Society of London, the Paleontological Society, the Society for Systematic Zoology, the American Littoral Society, the International Society for Reef Studies, and the Senckenbergische Naturforschende Gesellschaft. He

Figure 1. Dr. Harald Rehder. June 1971.

served as Editor of the *Journal of the Washington Academy of Sciences* from 1944–1946, as co-editor of *Indo-Pacific Mollusca* from 1959–1973, and on the editorial board of numerous scholarly publications.

He also belonged to many shell clubs, including Boston Malacological Club, and the Hawaiian Malacological Society. A Charter member of the National Capital Shell Club, he was elected as its first president in November 1960.

In addition he was a member of the Cosmos Club, The International Club of Washington, DC, The Explorers Club of New York City, and served on the Administrative Board of the Foundry United Methodist Church and its Susanna Wesley House, and was very active in the Homeless Mission. He enjoyed membership in the "Fossils," an organization of distinguished retired men.

Two genera and 24 species of Mollusca, 1 species of Foraminifera and 1 species of Pycnogonida have thusfar been named in his honor.

His wife of 50 years, Lois Corea Rehder, died in 1988. He is survived by a daughter, Anne F. van Beek-Rehder, of Amsterdam, The Netherlands; a son, Alfred L. Rehder of Germantown, Maryland, and three grandchildren.

II. MOLLUSCAN TAXA OF HARALD A. REHDER

During his career Harald Rehder introduced 397 molluscan taxa, of which 58 were genus-level taxa (34 genera and 24 subgenera, 1 subgenus as a replacement name), and 339 were species-level taxa (320 as species, 19 as subspecies, 8 species as replacement names). These are

Figure 2. Dr. Rehder at the American Malacological Union meeting in Fort Lauderdale, Florida, July, 1981.

listed alphabetically, by category. Data for genus-level taxa include taxon, author(s), year of publication, journal and page number, type species, and family to which currently assigned. Data for species-level taxa include taxon (original combination), author(s), year of publication, journal, page number and illustrations, type material, type repository and catalog number, general type locality, and family.

Genus-level Taxa

Abarbatia Dall, Bartsch and Rehder, 1938, as a subgenus of *Barbatia* Gray, 1847. Bernice P. Bishop Museum Bulletin 153:29. Type species: *Barbatia* (*Abarbatia*) *oahua* Dall, Bartsch and Rehder, 1938, by original designation. Arcidae.

Achasmea Dall, Bartsch and Rehder, 1938, as a subgenus of *Lciochasmea* Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:147. Type species: *Solecardia thaanumi* (Pilsbry, 1921), by original designation. Galeommatidae.

Anguipecten Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:92. Type species: *Angui-*

Figure 3. Formal portrait of Dr. Rehder, circa 1994.

pecten gregoryi Dall, Bartsch and Rehder, 1938, by original designation. Pectinidae.

Antemetula Rehder, 1943. Proceedings of the United States National Museum 93(3161):199. Type species *Buccinum metula* Hinds, 1844, by original designation. Buccinidae.

Barbarca Dall, Bartsch and Rehder, 1938, as a subgenus of *Calloarca* Gray, 1857. Bernice P. Bishop Museum Bulletin 153:23. Type species: *Calloarca* (*Barbarca*) *lua* Dall, Bartsch and Rehder, 1938, by original designation. Arcidae.

Bartschia Rehder, 1943. Proceedings of the United States National Museum 93(3161):199. Type species: *Bartschia significans* Rehder, 1943, by original designation. Buccinidae.

Cadella Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:196. Type species: *Tellina lechiogramma* Melville, 1893, by original designation. Tellinidae.

Cerodrillia Bartsch and Rehder, 1939. Proceedings of the United States National Museum 87(3070):127. Type species: *Cerodrillia clappi* Bartsch and Rehder, 1939, by original designation. Turridae.

Cornuteredo Dall, Bartsch and Rehder, 1938, as a subgenus of *Teredo* Linné, 1758. Bernice P. Bishop Museum Bulletin 153:209. Type species: *Teredo* (*Cornuteredo*) *milleri* Dall, Bartsch and Rehder, 1938, by original designation. Teredinidae. [see comments under *Teredo milleri*]

Crassispirella Bartsch and Rehder, 1939, as a subgenus of *Crassispira* Swainson, 1840. Proceedings of the United States National Museum 87(3070):135. Type species: *Crassispira* (*Crassispirella*) *rugitecta* (Dall, 1918), by original designation. Turridae.

Cryptopecten Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:93. Type species: *Cryptopecten alli* Dall, Bartsch and Rehder, 1938, by original designation. Pectinidae.

Dallimurex Rehder, 1946, as subgenus of *Paziella* Jousseaume, 1880. The Nautilus 59(4):142. Type species: *Murex nuttingi* Dall, 1896, by original designation. Muricidae.

Desmaulus Rehder, 1943, as a subgenus of *Bicatillus* Swainson, 1840. Proceedings of the Biological Society of Washington 56:45. Type species: *Calyptraca extinctorium* Lamarck, 1822, by original designation. Crepidulidae.

Diploplax Bartsch and Rehder, 1945, as a subgenus of *Martesia* Sowerby, 1824. Smithsonian Miscellaneous Collections 104(11):10. Type species: *Martesia* (*Diploplax*) *americana* Bartsch and Rehder, 1945, by original designation. Pholadidae.

Diplothyra Bartsch and Rehder, 1945, as a subgenus of *Martesia* Sowerby, 1824. Smithsonian Miscellaneous Collections 104(11):8. Type species: *Martesia* (*Diplothyra*) *smithii* (Tryon, 1862), by original designation. Pholadidae.

Dorisca Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:159. Type species: *Dorisca cookei* Dall, Bartsch and Rehder, 1938, by original designation. Veneridae.

Dysmea Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:173. Type species: *Solen occidens* Gmelin, 1791, by original designation. Psammobiidae.

Egentelaria Rehder, 1980. Smithsonian Contributions to Zoology 289:93. Type species: *Terebra stylata* Hinds, 1844, by original designation. Terebridae.

Glyphepithema Rehder, 1943. Proceedings of the United States National Museum 93(3161):196. Type species: *Natica idioponma* Pilsbry and Lowe, 1932, by original designation. Naticidae.

Halopsephus Rehder, 1943. Proceedings of the United States National Museum 93(3161):191. Type species: *Halopsephus pulcher* Rehder, 1943, by original designation. Turbinidae.

Haumea Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:86. Type species: *Haumea juddi* Dall, Bartsch and Rehder, 1938, by original designation. Pectinidae.

Hawaiarca Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:27. Type species: *Hawaiarca rectangula* Dall, Bartsch and Rehder, 1938, by original designation. Arcidae.

Hitia Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:135. Type species: *Hitia ovalis* Dall, Bartsch and Rehder, 1938, by original designation. Sportellidae.

Kaneoha Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:142. Type species: *Kaneoha rosea* Dall, Bartsch and Rehder, 1938, by monotypy. Kelliidae.

Kona Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:148. Type species: *Kona bucki* Dall, Bartsch and Rehder, 1938, by original designation. Montacutidae.

Kurodina Rehder, 1969, as subgenus of *Musashia* Hayashi, 1960. Venus, The Japanese Journal of Malacology 27(4):128. Type species: *Musashia* (*Kurodina*) *smithi* (Sowerby, 1901), by original designation. Volutidae.

Leiochasmea Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:146. Type species: *Leiochasmea chascax* (Pilsbry, 1921), by original designation. Galeommatidae.

Lissodrillia Bartsch and Rehder, 1939, as a subgenus of *Cerodrillia* Bartsch and Rehder, 1939. Proceedings of the United States National Museum 87(3070):129. Type species: *Cerodrillia* (*Lissodrillia*) *schroederi* Bartsch and Rehder, 1939, by original designation. Turridae.

Lonoa Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:178. Type species: *Lonoa hawaiensis* Dall, Bartsch and Rehder, 1938, by original designation. Semelidae.

Loxoglypta Dall, Bartsch and Rehder, 1938, as a subgenus of *Jactellina* Iredale, 1929. Bernice P. Bishop Museum Bulletin 153:192. Type species: *Tellina obliquilineata* Conrad, 1837, by original designation. Tellinidae.

Luetzenia Rehder, 1980. Smithsonian Contributions to Zoology 289:57. Type species: *Luetzenia goodingi* Rehder, 1980, by original designation. Eulimidae.

Microdochus Rehder, 1943. Proceedings of the United States National Museum 93(3161):193. Type species: *Microdochus floridanus* Rehder, 1943, by original designation. Elachisinidae.

Mirapecten Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:84. Type species: *Mirapecten thaanumi* Dall, Bartsch and Rehder, 1938, by original designation. Pectinidae.

Monilispira Bartsch and Rehder, 1939. Proceedings of the United States National Museum 87(3070):137. Type species: *Monilispira monilifera* (Carpenter, 1857), by original designation. Turridae.

Nanopitar Rehder, 1943, as a subgenus of *Pitar* Römer, 1857. Proceedings of the United States National Museum 93(3161):188. Type species: *Pitar* (*Nanopitar*) *pilula* Rehder, 1943, by original designation. Veneridae.

Nenisca Rehder, 1939, as a subgenus of *Nenia* H. & A. Adams, 1855. Journal of the Washington Academy of Sciences 29(4):171. Type species: *Nenia* (*Nenisca*) *bartschi* Rehder, 1939, by original designation. Clausiliidae.

Nesobornia Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:136. Type species: *Solecardia ovata* (Gould, 1850), by original designation. Kelliidae.

Nodochila Rehder, 1980. Smithsonian Contributions to Zoology 289:79. Type species: *Zafra pascua* Hertlein, 1962, by original designation. Columbellidae.

Paranenia Rehder, 1939, as a subgenus of *Nenia* H. & A. Adams, 1855. Journal of the Washington Academy of Sciences 29(4):173. Type species: *Nenia perarata* (von Martens, 1873), by original designation. Clausiliidae.

Particoma Bartsch and Rehder, 1945, as a subgenus of *Martesia* Sowerby, 1824. Smithsonian Miscellaneous Collections 104(11):5. Type species: *Martesia* (*Particoma*) *cuneiformis* (Say, 1822), by original designation. Pholadidae.

Paurodiscus Rehder, 1935, as a subgenus of *Pseudomalaxis* Fischer, 1885. The Nautilus 48(4):128. Type species: *Pseudomalaxis* (*Paurodiscus*) *lamellifera* Rehder, 1935, by monotypy. Architectonicidae.

Pectinistemma Rehder, 1940, as a subgenus of *Propilsbrya* Bartsch, 1906. Journal of the Washington Academy of Sciences 30(7):315. Type species: *Propilsbrya* (*Pectinistemma*) *kocstneri* Rehder, 1940, by original designation. Urocoptidae.

Phlycticoncha Bartsch and Rehder, 1940, as a subgenus of *Lyonsia* Turton, 1822. The Nautilus 53(4):137. Replacement name for *Phlyctiderma* Bartsch and Rehder, 1939, preoccupied by *Phlyctiderma* Dall, 1899. Lyonsiidae.

Phlyctiderma Bartsch and Rehder, 1939, as a subgenus of *Lyonsia* Turton, 1822. Smithsonian Miscellaneous Collections 98(10):12. Type species: *Lyonsia* (*Phlyctiderma*) *lucasana* Bartsch and Rehder, 1939, by original designation. Lyonsiidae. [see above].

Phycodrosus Rehder, 1943, as a subgenus of *Rissoella* Gray, 1847. Proceedings of the United States National Museum 93(3161):194. Type species: *Rissoella* (*Phycodrosus*) *caribaea* Rehder, 1943, by original designation. Rissoellidae.

Pitarenus Rehder and Abbott, 1951, as a subgenus of *Pitar* Römer, 1857. Revista de la Sociedad Malacologica

"Carlos de la Torre" 8(2):57. Type species: *Pitaria cordata* Schwengel, 1951, by original designation. Veneridae.

Policordia Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:217. Type species: *Policordia diomedea* Dall, Bartsch and Rehder, 1938, by original designation. Verticordiidae.

Privigna Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:160. Type species: *Privigna pilsbryi* Dall, Bartsch and Rehder, 1938, by original designation. Veneridae.

Psarostola Rehder, 1943. Proceedings of the United States National Museum 93(3161):198. Type species: *Columbella monilifera* Sowerby, 1844, by original designation. Columbellidae.

Radobornia Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:140. Type species: *Radobornia araia* Dall, Bartsch and Rehder, 1938, by original designation. Kelliidae.

Rubellatoma Bartsch and Rehder, 1939. Proceedings of the United States National Museum 87(3070):130. Type species: *Rubellatoma rubella* (Kurtz and Stimpson, 1851), by original designation. Turridae.

Sigaluta Rehder, 1967. Pacific Science, 21(2):182. Type species: *Sigaluta pratasensis* Rehder, 1967, by original designation. Marginellidae. [junior synonym of *Marginellona* Martens, 1904, see Harasewych and Kantor, 1991]

Siphovasum Rehder and Abbott, 1951, as a subgenus of *Vasum* Röding, 1798. Revista de la Sociedad Malacologica "Carlos de la Torre" 8(2):61. Type species: *Vasum latiriforme* Rehder and Abbott, 1951, by original designation. Turbinellidae.

Stellatoma Bartsch and Rehder, 1939. Proceedings of the United States National Museum 87(3070):132. Type species: *Stellatoma stellata* (Stearns, 1872), by original designation. Turridae.

Stenolena Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:60. Type species: *Stenolena hawaiensis* Dall, Bartsch and Rehder, 1938, by original designation. Mytilidae.

Terua Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:57. Type species: *Terua pacifica* Dall, Bartsch and Rehder, 1938, by original designation. Mytilidae.

Uroteuthis Rehder, 1945. Proceedings of the Biological Society of Washington 58:21. Type species: *Uroteuthis bartschi* Rehder, 1945, by original designation. Loliginidae.

Volutipysma Rehder, 1969, as subgenus of *Fulgoraria* Schumacher, 1817. Venus, The Japanese Journal of Malacology 27(4):130. Type species: *Fulgoraria (Volutipysma) humerosa* Rehder, 1969, by original designation. Volutidae.

Species-level taxa

Holotypes are deposited in the following institutions: **ANSP,** The Academy of Natural Sciences, Philadelphia, Pennsylvania, USA; **CAS,** California Academy of Natural Sciences, San Francisco, California, USA; **DMNH,** Delaware Museum of Natural History, Wilmington, Delaware, USA; **MCZ,** Museum of Comparative Zoology at Harvard University, Cambridge, Massachusetts, USA; **MNSH,** Museo Nacional de Historia Natural, Seccion Hidrobiologia, Santiago, Chile; **NM,** Natal Museum, Pietermaritzburg, South Africa; **NSMT,** National Science Museum, Tokyo, Japan; **SAM,** South African Museum, Cape Town, South Africa; **USNM,** National Museum of Natural History, Smithsonian Institution, Washington, DC, USA; and **WAM,** Western Australian Museum, Perth, Australia.

abyssicola, Calliotropis (*Solaricida*) Rehder and Ladd, 1973. Science Reports of the Tohoku University (ser. 2, Geology), Special volume 6:44, pl. 3, figs. 13–15. Holotype USNM 703266, Hess Guyot, central Pacific Ocean. Trochidae.

actinium, Cerithidium Rehder, 1980. Smithsonian Contributions to Zoology 289:33, pl. 5, figs. 17–18. Holotype USNM 339456, off Waikiki, Oahu, Hawaii. Diastomatidae.

acquicostata, Peronaeus Rehder, 1945. Revista Chilean de Historia Natural, 48(1944):5. Replacement name for *Bulinus* (*Peronaeus*) *scalarioides* Philippi *in* Pfeiffer, 1867, preoccupied by *Bulinus scalaroides* Reeve, 1849. Orthalicidae.

akuana, Planaxis (*Hinea*) Rehder, 1980. Smithsonian Contributions to Zoology 289:50, pl. 7, fig. 5. Holotype USNM 756793, Hanga Omiti, Easter Island. Planaxidae.

alarconi, Euchelus (*Herpetopoma*) Rehder, 1980. Smithsonian Contributions to Zoology 289:19, pl. 4, fig. 8. Holotype USNM 756195, Onetea, Hotuiti, Easter Island. Trochidae.

albata, Leptarionta venusta Rehder, 1942. Journal of the Washington Academy of Sciences 32(11):352, figs. 7–9. Holotype USNM 536030, Chiriqui Province, Panama. Helminthoglyptidae.

albomaculatus, Nassarius (*Telasco*) Rehder, 1980. Smithsonian Contributions to Zoology 289:82, pl. 10, figs. 4–5. Holotype USNM 751615, Te Raa Raa, Easter Island. Nassariidae.

alia, Hawaiarca Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:28, pl. 3, figs. 7–10. Holotype USNM 173221, northeast coast of Hawaii. Arcidae.

alli, Cryptopecten Dall, Bartsch and Rehder, 1938.

Bernice P. Bishop Museum Bulletin 153:93, pl. 23, figs. 1–4, 7. Holotype USNM 173194, off south coast of Oahu, Hawaii. Pectinidae.

allisoni, Pleurotomella Rehder and Ladd, 1973. Science Reports of the Tohoku University (ser. 2, Geology), Special volume 6:46, pl. 3, figs. 7–8. Holotype USNM 703269, Agassiz Guyot, central Pacific Ocean. Turridae.

ambatensis, Naesiotus quitensis Rehder, 1940. The Nautilus 53(4):117, pl. 13, figs. 12, 14. Holotype USNM 473973, Ambato, Prov. del Tunguragua, Ecuador. Orthalicidae.

ambla, Ervilia (Spondervilia) Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:171, pl. 44, figs. 5–8. Holotype USNM 484195, Hilo, Hawaii. Mesodesmatidae.

americana, Martesia (Diploplax) Bartsch and Rehder, 1945. Smithsonian Miscellaneous Collections 104(11): 13, pl. 2 figs. 1–2, pl. 3, figs. 3–4. Holotype USNM 573550, Fort Dade, Florida. Pholadidae.

amydroglyptum, Caecum Rehder, 1980. Smithsonian Contributions to Zoology 289:32, pl. 5, fig. 12. Holotype USNM 757977, Onetea, Hotuiti, Easter Island. Caecidae.

angulata, Anisodonta Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:125, pl. 34, figs. 5–6. Holotype USNM 427774, near Koko Head, Maunalua Bay, Oahu, Hawaii. Sportellidae.

antisana, Naesiotus quitensis Rehder, 1942. The Nautilus 55(3):103. Holotype USNM 516940, Mt. Antisana, Province of Pichincha, Ecuador. Orthalicidae.

aporema, Triphora Rehder, 1980. Smithsonian Contributions to Zoology 289:43, pl. 6, fig. 13. Holotype ANSP 321077, Easter Island. Triphoridae.

aquilum, Cerithiopsis Rehder, 1980. Smithsonian Contributions to Zoology 289:40, pl. 6, fig. 9. Holotype MNSH 200388, Easter Island. Cerithiopsidae.

araia, Radobornia Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:140, text-fig. 17, pl. 37, figs. 5–8. Holotype USNM 484183, Keokea, Hilo, Hawaii. Kelliidae.

arcella, Cirsotrema (Cirsotremopsis) Rehder, 1945. Proceedings of the Biological Society of Washington 58:128. Holotype USNM 83725, southwest of Cape Hatteras, North Carolina. Epitoniidae.

arcsta, Pusiolina Rehder, 1943. Proceedings of the United States National Museum 93(3161):201, pl. 20, fig. 1. Holotype USNM 517056, Santa Rosa, Pinar del Rio, Cuba. Costellariidae.

argoblysis, Bulla (Leucophysema) Rehder and Ladd, 1973. Science Reports of the Tohoku University (ser. 2, Geology), Special volume 6:47, pl. 3, figs. 5–6. Holotype USNM 703272, Horizon Guyot, Mid-Pacific Mountains, central Pacific Ocean. Bullidae.

atlantica, Cooperella Rehder, 1943. Proceedings of the United States National Museum 93(3161):187, pl. 19, figs. 3–4. Holotype USNM 517058, off Peanut Island, northern Lake Worth, Florida. Cooperellidae.

auaua, Lima Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:106, pl. 27, figs. 5–8. Holotype USNM 335607, Auau Channel, Hawaii. Limidae.

aureofasciatus, Conus spurius Rehder and Abbott, 1951. Revista de la Sociedad Malacologica "Carlos de la Torre" 8(2):64, pl. 9, figs. 3–4. Holotype USNM 597521, off Dry Tortugas, Florida. Conidae.

austini, Conus Rehder and Abbott, 1951. Journal of the Washington Academy of Sciences 41(1):22, fig. 7. Holotype USNM 603017, southeast of Loggerhead Key, Dry Tortugas, Florida. Conidae.

aviarius, Musculus Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:53, pl. 10, figs. 1–4. Holotype USNM 173231, near Moku Manu, Hawaii. Mytilidae.

bahamensis, Martesia (Dioloplax) Bartsch and Rehder, 1945. Smithsonian Miscellaneous Collections 104(11): 11, pl. 3, figs. 15–16. Holotype USNM 573549, eastern end of South Bight, Andros Island, Bahamas. Pholadidae.

bahamondei, Hemiliostraca Rehder, 1980. Smithsonian Contributions to Zoology 289:55, pl. 7, fig. 13. Holotype USNM 766572, Easter Island. Eulimidae.

bahamondei, Zeidora Rehder, 1980. Smithsonian Contributions to Zoology 289:17, pl. 4, figs. 4–5. Holotype MNSH 200403, Vaihu, Easter Island. Fissurellidae.

baileyi, Nitidella guttata Bartsch and Rehder, 1939. Smithsonian Miscellaneous Collections 98(10):6, pl. 2, fig. 6. Holotype USNM 472857, Elizabeth Bay, Albermarle Island, Galapagos Islands. Columbellidae.

bakeri, Botulina Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:55, pl. 11, figs. 7–8. Holotype USNM 484182 [incorrectly published as 484183], Hilo, Hawaii. Mytilidae.

baldwini, Solecurtus Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:176, pl. 45, figs. 9–10. Holotype USNM 335618, off south coast of Molokai, Hawaii. Psammobiidae.

balesi, Asthenothaerus Rehder, 1943. Proceedings of the United States National Museum 93(3161):189, pl. 19, figs. 13–14. Holotype USNM 536052, Missouri Key, Florida. Thracidae.

barkeri, Tegula (Chlorostoma) Bartsch and Rehder, 1939. Smithsonian Miscellaneous Collections 98(10):11, pl. 2, figs. 10–12. Holotype USNM 472589, Elizabeth Bay, Albemarle Island, Galapagos Islands. Trochidae.

barnardi, Fusivoluta Rehder, 1969. The Veliger 11(3): 207, pl. 40, fig. 9, pl. 43, figs. 40–43. Holotype DNMH 10751, off Natal coast. Volutidae.

bartschi, Nenia (*Nenisca*) Rehder, 1939. Journal of the Washington Academy of Sciences 29(4):171, figs. 1–5. Holotype USNM 380074, Mt. Rochelle (or Rochelois), south of Rochelois, Haiti. Clausiliidae.

bartschi, Oocorys Rehder, 1943. Proceedings of the United States National Museum 93(3161):197, pl. 20, fig. 16. Holotype USNM 535689, south of Tortugas, Florida. Cassidae.

bartschi, Turbonilla (*Careliopsis*) Aguayo and Redher, 1936. Memorias de la Sociedad Cubana de Historia Natural 9(4):267, pl. 24, fig. 7. Holotype USNM 420975, La Chorrera, Habana, Cuba. Pyramidellidae.

bartschi, Urotcuthis Rehder, 1945. Proceedings of the Biological Society of Washington 58:22, pl. 3, figs. 1–2. Holotype USNM 573515, Jolo Harbor, Jolo, Philippine Islands. Loliginidae.

bayeri, Natica (*Glyphepithema*) Rehder, 1986. The Nautilus 100(1):38. Replacement name for *Glyphepithema floridana* Rehder, 1943, preoccupied by *Natica (Cryptonatica) floridana* Dall, 1892. Naticidae. [see *tedbayeri, Natica* Rehder, 1986]

bermudezi, Rissoina (*Folinia*) Aguayo and Redher, 1936. Memorias de la Sociedad Cubana de Historia Natural 9(4):265, text-fig. 1, pl. 24, fig. 5. Holotype USNM 436307, Tortugas, Florida. Rissoidae.

blakei, Vitrinella Rehder, 1944. The Nautilus 57(3):97, pl. 9, figs. 1–2. Holotype USNM 537834, Talbot formation (Pleistocene) at Wailes Bluff (near Cornfield Harbor), St. Mary's County, Maryland. Vitrinellidae.

boswellae, Volutocorbis Rehder, 1969. The Veliger 11(3): 202, pl. 40, fig. 5, pl. 41, figs. 16–19. Holotype USNM 683585, off Mossellbaai (Mossel Bay), South Africa. Volutidae.

bountyi, Fusinus galathcae Rehder and Wilson, 1975. Smithsonian Contributions to Zoology 203:10, text-figs. 6–8. Holotype USNM 707230, off NW coast of Pitcairn Island. Fasciolariidae.

bourgeoisae, Drymaeus Rehder, 1943. The Nautilus 57(1):28, pl. 6, fig. 10. Holotype USNM 517550, near Paraje Nuevo (near Córdoba), Vera Cruz, Mexico. Orthalicidae.

branhamae, Fasciolaria distans Rehder and Abbott, 1951. Revista de la Sociedad Malacologica "Carlos de la Torre" 8(2):59, pl. 8, figs. 4–5. Holotype USNM 597513, off Puerto Alvaro Obregon, Tabasco, Mexico. Fasciolariidae.

brunnescens, Fenimorea moseri Rehder, 1943. Proceedings of the United States National Museum 93(3161): 202, pl. 20, fig. 5. Holotype USNM 517055, off Fort Walton, Okaloosa County, Florida. Turridae.

bucki, Kona Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:149, text-fig. 25, pl. 39, figs. 13–16. Holotype USNM 333067, near Koko Head, Oahu, Hawaii. Montacutidae.

candens, Acteon Rehder, 1939. The Nautilus 53(1):21, pl. 6, fig. 7. Holotype USNM 493407, off Fowey Light, Florida. Acteonidae.

caribaea, Rissoella (*Phycodrosus*) Rehder, 1943. Proceedings of the United States National Museum 93(3161):194, pl. 20, fig. 7. Holotype USNM 536046, Bonefish Key, Florida. Rissoellidae.

caribbaea, Tritonalia (*Ocinebrina*) Bartsch and Rehder, 1939. Smithsonian Miscellaneous Collections 98(10):7, pl. 1, fig. 1. Holotype USNM 472617, Old Province Island, Colombia [Caribbean]. Muricidae.

carnecpicta, Phenacovolva Rehder and Wilson, 1975. Smithsonian Contributions to Zoology 203:6, frontispiece figs. 6, 9, 12. Holotype USNM 707232, Haava Strait, Marquesas Islands. Ovulidae.

cayosense, Caecum (*Caecum*) Rehder, 1943. Proceedings of the United States National Museum 93(3161):190, pl. 20, fig. 9. Holotype USNM 536045, Bonefish Key, Florida Keys. Caecidae.

cedrosensis, Aplysia Bartsch and Rehder, 1939. Smithsonian Miscellaneous Collections 98(10):2, pl. 4, figs. 8–10, pl. 5. Holotype USNM 472859, east side of Cedros Island, Lower California, Mexico. Aplysiidae.

cernohorskyi, Ziba Rehder and Wilson, 1975. Smithsonian Contributions to Zoology 203:13, text-fig. 9, frontispiece fig. 13. Holotype USNM 707239, off NW corner of Pitcairn Island. Mitridae.

chilena, Calliostoma Rehder, 1971. Proceedings of the Biological Society of Washington 83(51):590, figs. 2, 5. Holotype USNM 701669, NW of Valparaiso, Chile. Trochidae.

clappi, Cerodrillia (*Cerodrillia*) Bartsch and Rehder, 1939. Proceedings of the United States National Museum 87(3070):128, pl. 17, fig. 4. Holotype USNM 493408, Hawk Channel, Florida. Turridae.

clarkei, Fusivoluta Rehder, 1969. The Veliger 11(3):206, pl. 40, fig. 8, pl. 43, figs. 37–39. Holotype DNMH 12833, off João Belo, District Gaza, Mozambique. Volutidae.

clarki, Conus Rehder and Abbott, 1951. Journal of the Washington Academy of Sciences 41(1):22, figs. 1–6. Holotype USNM 485740, southwest of Marsh Island, Iberia County, Louisiana. Conidae.

clenchi, Polygyra Rehder, 1932. The Nautilus 45(4):129, pl. 10, figs. 1–3. Holotype MCZ 81347, Izard County Arkansas. Polygyridae.

clippertonensis, Ctena Bartsch and Rehder, 1939. Smithsonian Miscellaneous Collections 98(10):13, pl. 3, figs. 1–5. Holotype USNM 472552, Clipperton Island, East Pacific Ocean. Lucinidae.

codoccoae, Heliacus Rehder, 1980. Smithsonian Contri-

butions to Zoology 289:32, pl. 5, figs. 13–15. Holotype ANSP 321078, Easter Island. Architectonicidae.

consobrinella, Zafrona Rehder, 1980. Smithsonian Contributions to Zoology 289:76, pl. 9, figs. 12–13. Holotype USNM 756156, Haka Ea, Vaihu, Easter Island. Columbellidae.

cookei, Chlamys Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:90, pl. 24, figs. 1–4. Holotype USNM 484166, off entrance to Honolulu Harbor, Oahu, Hawaii. Pectinidae.

cookei, Dorisca Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:160, pl. 42, figs. 5–8. Holotype USNM 484190, Pearl Harbor, Oahu, Hawaii. Veneridae.

costaricana, Systrophia (Systrophiella) Rehder, 1942. Journal of the Washington Academy of Sciences 32(11): 352, figs. 13–15. Holotype USNM 536023, Coto, on the Golfo Dulce, Puntarenas Province, Costa Rica. Systrophiidae.

costaricensis, Thysanophora Rehder, 1942. Journal of the Washington Academy of Sciences 32(11):352, figs. 1–3. Holotype USNM 536009, La Caja, near San Jose, San Jose Province, Costa Rica. Thysanophoridae.

crassula, Kermia Rehder, 1980. Smithsonian Contributions to Zoology 289:89, pl. 11, fig. 2. Holotype MNSH 200397, Vaihu, Easter Island. Turridae.

crassula, Merelina (Mereliniopsis) Rehder, 1980. Smithsonian Contributions to Zoology 289:30, pl. 5, fig. 9. Holotype USNM 767026, Onetea, Hotuiti, Easter Island. Rissoidae.

cruda, Arcinella Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:118, pl. 33, figs. 9–10. Holotype USNM 335601, off south coast of Molokai, Hawaii. Chamidae.

crypta, Terua Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:58, pl. 11, figs. 5–6. Holotype USNM 333333, off Oahu, Hawaii. Mytilidae.

cubanum, Vexillum Aguayo and Redher, 1936. Memorias de la Sociedad Cubana de Historia Natural 9(4):267, pl. 24, fig. 4. Holotype USNM 420978, type locality not published. [Holotype from La Chorrera, Habana, Cuba]. Costellariidae.

dalli, Cirsotrema (Cirsotremopsis) Rehder, 1945. Proceedings of the Biological Society of Washington 58:128. Holotype USNM 515240, off Cape San Blas, Florida, Gulf of Mexico. Epitoniidae.

dichrous, Semelangulus Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:180, pl. 46, figs. 1–4. Holotype USNM 362356, Midway Island. Tellinidae.

diodorus, Semelangulus Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:181, pl. 46, figs. 9–12. Holotype USNM 484201, off Launiupoko, Maui, Hawaii. Tellinidae.

diomedea, Glycymeris Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:38, pl. 6, figs. 3–4. Holotype USNM 172987, off south coast of Molokai, Hawaii. Glycymeridae.

diomedea, Policordia Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:217, pl. 56, figs. 5–8. Holotype USNM 335685, Pailolo Channel, Hawaii. Verticordiidae.

diomedea, Rubellatoma Bartsch and Rehder, 1939. Proceedings of the United States National Museum 87(3070):131, pl. 17, fig. 3. Holotype USNM 508645, Sanibel Island, Florida. Turridae.

diomedeum, Propeamussium Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:83, pl. 20, figs. 3–4, pl. 21, figs. 1–4. Holotype USNM 190442, Pailolo Channel, Hawaii. Propeamussiidae.

diomedeus, Pecten Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:96, pl. 24, figs. 7–8. Holotype USNM 335570 [incorrectly published as 355570], off south coast of Molokai, Hawaii. Pectinidae.

dispar, Cuspidaria (Myonera) Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:225, pl. 58, figs. 5–7. Holotype USNM 110752, off south coast of Molokai, Hawaii. Cuspidariidae.

disparilis, Volutocorbis Rehder, 1969. The Veliger 11(3): 203, pl. 40, fig. 4, pl. 41, figs. 20–22. Holotype SAM A3335, 125 miles off Saint Sebastian Bay (36°40′S, 21°26′E), South Africa. Volutidae.

earlyi, Engina Bartsch and Rehder, 1939. Smithsonian Miscellaneous Collections 98(10):6, pl. 1, fig. 8. Holotype USNM 472566, Sulivan Bay, James Island, Galapagos Islands. Buccinidae.

edmondsoni, Periglypta Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:162, pl. 43, figs. 1–4. Holotype USNM 484193, Hilo, Hawaii. Veneridae.

englerti, Rissoina (Rissolina) turricula Rehder, 1980. Smithsonian Contributions to Zoology 289:26, pl. 5, fig. 6. Holotype USNM 755993, Hanga Papara, Easter Island. Rissoidae.

epiphanea, Pusia Rehder, 1943. Proceedings of the United States National Museum 93(3161):201, pl. 20, fig. 14. Holotype USNM 414278, off Tortugas, Florida. Costellariidae.

esperanzae, Stomatella Rehder, 1980. Smithsonian Contributions to Zoology 289:20, pl. 4, figs. 9–11. Holotype USNM 756113, Haka Ea, Vaihu, Easter Island. Stomatellidae.

eucharis, Triphora Rehder, 1980. Smithsonian Contributions to Zoology 289:46, pl. 6, fig. 16. Holotype ANSP 339946, Easter Island. Triphoridae.

eugrammatus, Conus Bartsch and Rehder, 1943. Proceedings of the Biological Society of Washington 56:85 Holotype USNM 173213, off north coast of Molokai Island (near Mokapu Islet), Hawaii. Conidae.

exilirata, Lienardia Rehder, 1980. Smithsonian Contributions to Zoology 289:86, pl. 11, figs. 7–9. Holotype USNM 758393, Haka Ea, Vaihu, Easter Island. Turridae.

exomilisca, Triphora Rehder, 1980. Smithsonian Contributions to Zoology 289:45, pl. 6, fig. 15. Holotype USNM 756779, Onetea, Hotuiti, Easter Island. Triphoridae.

exquisita, Martesia (*Dioloplax*) Bartsch and Rehder, 1945. Smithsonian Miscellaneous Collections 104(11): 10, pl. 3, figs. 17–18. Holotype USNM 573548, Stony Cove, St. Mary's Parish, Jamaica. Pholadidae.

exquisita, Pinna Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:75, pl. 17, figs. 1–2. Holotype USNM 335610, near Laysan Island, Hawaii. Pinnidae.

fasciola, Lithophaga Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:57, pl. 11, figs. 1–4. Holotype USNM 337458, off Launiupoko Camp, Maui, Hawaii. Mytilidae.

filosa, Pyrgocythara Rehder, 1943. Proceedings of the United States National Museum 93(3161):203, pl. 20, fig. 2. Holotype USNM 27637, Marco, Florida. Arcidae.

fimbriata, Hipponix Bartsch and Rehder, 1939. Smithsonian Miscellaneous Collections 98(10):10, pl. 2, figs. 7–9. Holotype USNM 472853, Clipperton Island, East Pacific Ocean. Hipponicidae.

floridana, Anachis Rehder, 1939. The Nautilus 53(1):20, pl. 6, fig. 6. Holotype USNM 473202, near Cape Canaveral, Brevard County, Florida. Columbellidae.

floridana, Glyphepithema Rehder, 1943. Proceedings of the United States National Museum 93(3161):196, pl. 19, figs. 19–21. Holotype USNM 517060, Peanut Island, Lake Worth, Florida. Naticidae. [see *bayeri, Natica* Rehder, 1986]

floridana, Tivela Rehder, 1939. The Nautilus 53(1):18, pl. 6, figs. 2–3. Holotype USNM 473118, Jensen Beach (near Miami), Florida. Veneridae.

floridanus, Microdochus Rehder, 1943. Proceedings of the United States National Museum 93(3161):193, pl. 20, fig. 6. Holotype USNM 536048, Bonefish Key, Florida. Type locality corrected (The Nautilus 57(1):32) to Missouri Key. Elachisinidae.

fretensis, Gemma Rehder, 1939. The Nautilus 53(1):18, pl. 6, figs. 8–9. Holotype USNM 508650, Long Island Sound, New York. Veneridae.

funisicola, Martesia (*Diploplax*) Bartsch and Rehder, 1945. Smithsonian Miscellaneous Collections 104(11): 14, pl. 3, figs. 1–2, 13–14. Holotype USNM 573551, Lake Worth, Florida. Pholadidae.

fuscobasis, Clathurella Rehder, 1980. Smithsonian Contributions to Zoology 289:87, text-fig. 11, pl. 11, figs. 3–4. Holotype USNM 756265, Onetea, Hotuiti, Easter Island. Turridae.

gayi, Peronaeus Rehder, 1945. Revista Chilean de Historia Natural, 48(1944):4. Holotype USNM 537831, Antofagasta, Chile. Orthalicidae.

gloriosus, Spondylus Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:102, pl. 26, figs. 8–11. Holotype USNM 190435, off Penguin Bank, south coast of Oahu, Hawaii. Spondylidae.

goodingi, Luetzenia Rehder, 1980. Smithsonian Contributions to Zoology 289:58, pl. 7, fig. 16. Syntypes (79) USNM, ZMC, AMS, MNSH, Easter Island. Eulimidae.

goodwini, Harpa Rehder, 1993. The Nautilus 106(4): 127, figs. 1–2. Holotype USNM 860312, French Frigate Shoals, Hawaii. Harpidae.

gouldi, Halicardia Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:218, pl. 56, figs. 1–4. Holotype USNM 335682, off Hawaii. Verticordiidae.

gracilior, Benthovoluta Rehder, 1967. Pacific Science, 21(2):185, figs. 5–6. Holotype USNM 637252, off Cagayan Islands, northern Sulu Sea, Philippines. Turbinellidae.

gregoryi, Anguipecten Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:93, pl. 23, figs. 5–6, 8. Holotype USNM 173227, near Kauai, Hawaii. Pectinidae.

gregoryi, Teredo (*Teredora*) Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:212, pl. 55, figs. 1–5. Holotype USNM 337316, Keaukaha, Hilo, Hawaii. Teredinidae. [junior synonym of *Teredora princesae* (Sivickis, 1928), seeTurner, 1966:103]

halitropus, Conus Bartsch and Rehder, 1943. Proceedings of the Biological Society of Washington 56:88. Holotype USNM 338579, at dredger dump at Honolulu, Oahu, Hawaii. Conidae.

hammatus, Conus Bartsch and Rehder, 1943. Proceedings of the Biological Society of Washington 56:86. Holotype USNM 173225, near Kauai Island, Hawaii. Conidae.

hataii, Calliotropis (*Solaricida*) Rehder and Ladd, 1973. Science Reports of the Tohoku University (ser. 2, Geology), Special volume 6:43, pl. 3, figs. 16–18. Holotype USNM 703263, Hess Guyot, central Pacific Ocean. Trochidae.

haustrellum, Succinea Rehder, 1942. Journal of the Washington Academy of Sciences 32(11):350, fig. 19. Holotype USNM 536013, Pedernal, Guanacaste Province, Costa Rica. Succineidae.

hawaia, Barbatia (*Abarbatia*) Dall, Bartsch and Rehder,

1938. Bernice P. Bishop Museum Bulletin 153:32, pl. 4, figs. 1–4. Holotype USNM 484154 [incorrectly published as 485154], Keaukaha, Hilo, Hawaii. Arcidae.

hawaia, Lithophaga Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:56, pl. 11, figs. 9–10. Holotype USNM 337459, entrance of Hololulu Harbor, Oahu, Hawaii. Mytilidae.

hawaiana, Lima Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:105, pl. 28, figs. 5–6. Holotype USNM 173202, off south coast of Molokai, Hawaii. Limidae.

hawaiana, Meiocardia Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:121, pl. 34, figs. 17–18. Holotype USNM 173048, near Kauai, Hawaii. Cardiidae.

hawaiensis, Acar Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:14, text-fig. 3, pl. 1, figs. 5–8. Holotype USNM 427766, Keaukaha, Hilo, Hawaii. Arcidae.

hawaiensis, Angulus Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:198, pl. 50, figs. 9–12. Holotype USNM 484200, entrance to Honolulu Harbor, Oahu, Hawaii. Tellinidae.

hawaiensis, Arcinella Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:118, pl. 33, figs. 11–14. Holotype USNM 335602, off northeast coast of Hawaii. Chamidae.

hawaiensis, Bentharca Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:20, pl. 3 figs. 15–18. Holotype USNM 427759, off south coast of Oahu, Hawaii. Arcidae.

hawaiensis, Botula Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:59, pl. 12, figs. 1–4. Holotype USNM 484180, off south coast of Molokai, Hawaii. Mytilidae.

hawaiensis, Carditella Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:120, pl. 33, figs. 5–8. Holotype USNM 484175, off Waikiki, Oahu, Hawaii. Carditidae.

hawaiensis, Chlamys Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:88, pl. 22, figs. 5–8. Holotype USNM 484165, Honolulu side of entrance to channel to Pearl Harbor, Oahu, Hawaii. Pectinidae.

hawaiensis, Cuspidaria Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:226, pl. 58, figs. 1–4. Holotype USNM 173012, Pailolo Channel, Hawaii. Cuspidariidae.

hawaiensis, Kellia Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:143, text-fig. 20, pl. 38, figs. 15–18. Holotype USNM 361563, Fort Armstrong, Oahu, Hawaii. Kelliidae.

hawaiensis, Lasaea Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:141, text-fig. 18, pl. 38, figs. 1–4. Holotype USNM 484184, Keaau, Hawaii. Lasaeidae.

hawaiensis, Lonoa Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:179, pl. 46, figs. 5–8. Holotype USNM 337471, Keokea, Hilo, Hawaii. Semelidae.

hawaiensis, Loripinus Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:127, pl. 34, figs. 11–12. Holotype USNM 337404, entrance to Honolulu Harbor, Oahu, Hawaii. Lucinidae.

hawaiensis, Martesia Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:205, pl. 52, figs. 1–7. Holotype USNM 484213, Pearl Harbor, Oahu, Hawaii. Pholadidae.

hawaiensis, Pinna Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:73, pl. 17, figs. 8–11. Holotype USNM 337508, off Kaanapali, Maui, Hawaii. Pinnidae.

hawaiensis, Rocellaria Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:202, pl. 51, figs. 1–5. Holotype USNM 484206, Ford Island, Oahu, Hawaii. Gastrochaenidae.

hawaiensis, Saxicava Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:200, pl. 50, figs. 13–14. Holotype USNM 484204, Fort Armstrong, Oahu, Hawaii. Hiatellidae.

hawaiensis, Spondylus Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:100, pl. 25, figs. 1–4. Holotype USNM 337515, off Honolii reef, Hilo, Hawaii. Spondylidae.

hawaiensis, Stenolena Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:60, text-fig. 14, pl. 12, figs. 6–7. Holotype USNM 110427, off south coast of Molokai, Hawaii. Mytilidae.

hawaiensis, Teredo (Teredops) Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:213, pl. 55, figs. 6–8. Holotype USNM 335077, off south coast of Oahu, Hawaii. Teredinidae. [junior synonym of *Lyrodus pedicellatus* (Quatrefages, 1849), see Turner, 1966:104]

hawaiensis, Trachycardium Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:155, pl. 41, figs. 1–4. Holotype USNM 337390, Keaukaha, Hilo, Hawaii. Cardiidae.

hawaiensis, Venus Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:164, pl. 42, figs. 13–15. Holotype USNM 335581 [incorrectly published as 335881], near Kauai, Hawaii. Veneridae.

hemphilli, Pyrgocythara Bartsch and Rehder, 1939. Proceedings of the United States National Museum 87(3070):132, pl. 17, fig. 2. Holotype USNM 86898a, Sarasota Bay, Florida. Turridae.

hendersoni, Barbatia (*Abarbatia*) Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:33, text-fig. 12, pl. 5, figs. 5–6. Holotype USNM 427768, outcrop in the road that leads from the main route into the Pearl Harbor grounds, Oahu, Hawaii. Arcidae.

hendersoni, Chama Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:150, pl. 40, figs. 5–8. Holotype USNM 484174, Pearl Harbor, Oahu, Hawaii. Chamidae.

hendersoni, Cymatoica orientalis Rehder, 1939. The Nautilus 53(1):19, pl. 6, figs. 10–11. Holotype USNM 493384, Fowey Light, near Miami, Florida. Tellinidae.

hendersoni, Pusia Rehder, 1943. Proceedings of the United States National Museum 93(3161):200, pl. 20, fig. 12. Holotype USNM 414359, off Bears Cut, Miami, Florida. Costellariidae.

hiloa, Barbatia (*Abarbatia*) Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:34, pl. 4, figs. 13–16. Holotype USNM 427769, Keaukaha, Hilo, Hawaii. Arcidae.

hiloa, Scintilla Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:146, text-fig. 22, pl. 38, figs. 11–14. Holotype USNM 484187, Keokea, Hilo, Hawaii. Galeommatidae.

houstonius, Brachidontes multiformis Bartsch and Rehder, 1939. Smithsonian Miscellaneous Collections 98(10):14, pl. 4, figs. 4–7. Holotype USNM 472858, Sulivan Bay, James Island, Galapagos Islands. Mytilidae.

hua, Calloarca (*Barbarca*) Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:24, text-fig. 8, pl. 4, figs. 5–8. Holotype USNM 427760, entrance to Pearl Harbor, Oahu, Hawaii. Arcidae.

humboldti, Bathybembix Rehder, 1971. Proceedings of the Biological Society of Washington 83(51):587, fig. 4. Holotype USNM 701665, NW of Valparaiso, Chile. Trochidae.

humerosa, Fulgoraria (*Volutipyrsma*) Rehder, 1969. Venus, The Japanese Journal of Malacology 27(4):130, pl. 7, figs. 5–7. Holotype USNM 237732, SSW of Tung-sha-Tao (Pratas Island), South China Sea. Volutidae.

jacksoni, Naesiotus quitensis Rehder, 1940. The Nautilus 53(4):116, pl. 13, figs. 1, 5. Holotype USNM 473969, Guaillabamba (northeast of Quito), Ecuador. Orthalicidae.

jaumei, Diadora [*sic*] Aguayo and Rehder, 1936. Memorias de la Sociedad Cubana de Historia Natural 9(4): 263, pl. 24, fig. 6. Holotype USNM 420974, Varadero, Matanzas, Cuba. Fissurellidae.

juddi, Haumea Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:86, pl. 22, figs. 1–4. Holotype USNM 337538, off Kaanapali, Maui, Hawaii. Pectinidae.

kajiyamai, Harpa Rehder, 1973. Indo-Pacific Mollusca 3(16):244, pl. 188, figs. 3–4. Holotype NSMT 41450, southern Philippines. Harpidae. [junior synonym and junior homonym of *Harpa kajiyamai* Habe *in* Habe and Kosuge, 1972, see Petit & Bieler, 1996:44]

kanaka, Rocellaria Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:203, pl. 51, figs. 11–15. Holotype USNM 337379, Mokuoloe Island, Kaneohe Bay, Oahu, Hawaii. Gastrochaenidae.

kauaia, Glycymeris Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:40, pl. 7, figs. 2–3. Holotype USNM 173043, near Kauai, Hawaii. Glycymeridiidae.

kauaia, Navicula Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:11, pl. 1, figs. 9–12. Holotype USNM 335696, off Kauai, Hawaii. Arcidae.

kauaia, Ostrea Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:112, pl. 30, figs. 8–9. Holotype USNM 335585, near Kauai, Hawaii. Ostreidae.

kauaiensis, Bentharca Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:22, text-fig. 7, pl. 3, figs. 5–6. Holotype USNM 173232, near Kauai, Hawaii. Arcidae.

kauaiensis, Chlamys Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:92, pl. 22, figs. 9–10. Holotype USNM 335674, near Kauai, Hawaii. Pectinidae.

kauaiensis, Spondylus Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:103, pl. 26, figs. 12–13. Holotype USNM 335638, near Kauai, Hawaii. Spondylidae.

kauaiensis, Teredo (*Teredops*) Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:214. These authors affixed the name *T. kauaiensis* to Miller's (1924) description of what he believed to be *Teredo diegensis* Bartsch,1916, from Pearl Harbor, Honolulu Harbor, and Nawiliwili. They comment that they have not had specimens of this species for examination. There can be no type material for *Teredo kauaiensis*, as neither specimens nor figs. were associated with the name by either Miller or Dall, Bartsch and Rehder. Teredinidae. [synonym of *Lyrodus pedicellatus* Quatrefages, 1849, see Turner, 1966:106]

kauaium, Propeamussium Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:80, pl. 19, figs. 4–7, pl. 20 figs. 1–2. Holotype USNM 173218, near Kauai, Hawaii. Propeamussiidae.

keolua, Lima Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:107, pl. 27, figs. 13–16. Holotype USNM 337519, Kaneohe Bay, Oahu, Hawaii. Limidae.

kilburni, Volutocorbis Rehder, 1974. The Nautilus 88(2): 36, figs. 5–8. Holotype USNM 709352, off Durban, Natal. Volutidae.

kingae, Cypraea Rehder and Wilson, 1975. Smithsonian Contributions to Zoology 203:2, text-figs. 1–3, frontispiece figs. 1, 4–5, 7–8. Holotype USNM 707234, off NW point of Pitcairn Island. Cypraeidae.

kona, Glycymeris Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:41, pl. 7, figs. 8–9. Holotype USNM 427765, off south coast of Oahu, Hawaii. Glycymeridae.

koestneri, Propilsbrya (*Pectinistemma*) Rehder, 1940. Journal of the Washington Academy of Sciences 30(7): 316, figs. 1–3. Holotype USNM 535762, Cerro Potosi at Galeana, Nuevo Leon, Mexico. Urocoptidae.

kupua, Ostrea Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:111, pl. 30, figs. 1–4. Holotype USNM 484156, Pearl Harbor, Oahu, Hawaii. Ostreidae.

laciniata, Pteria Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:70, pl. 17, figs. 5–7. Holotype USNM 335666, off northeast coast of Hawaii. Pteriidae.

lahaina, Lima Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:105, pl. 27, figs. 1–4. Holotype USNM 484169, off Lahaina, Maui, Hawaii. Limidae.

lamellifera, Pseudomalaxis (*Paurodiscus*) Rehder, 1935. The Nautilus 48(4):128, pl. 7, figs. 8–10. Holotype USNM 426235, Florida Straits. Architectonicidae.

langfordi, Nodipecten Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:85, pl. 21, figs. 9–12. Holotype USNM 337541, off Waikiki, Oahu, Hawaii. Pectinidae.

latilirata, Coralliophila Rehder, 1985. The Nautilus 99(4):97, figs. 1–3. Holotype USNM 731531, Oeno, Pitcairn Islands. Coralliophilidae.

latiriforme, Vasum (*Siphovasum*) Rehder and Abbott, 1951. Revista de la Sociedad Malacologica "Carlos de la Torre" 8(2):61, pl. 9, figs. 5–6. Holotype USNM 597517, NW of Cape Catoche, Yucatan, Mexico. Turbinellidae.

laysana, Acar Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:16, text-fig. 4, pl. 1, figs. 13–16. Holotype USNM 335647, off Laysan Island, Hawaii. Arcidae.

laysana, Arcinella Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:118, pl. 33, figs. 15–18. Holotype USNM 484178, Laysan Island, Hawaii. Chamidae.

laysana, Botula Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:60, pl. 12, fig. 5. Holotype USNM 335614, near Laysan Island, Hawaii. Mytilidae.

laysana, Ostrea Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:111, pl. 32, figs. 5–8. Holotype USNM 484157, off Laysan Island, Hawaii. Ostreidae.

laysanus, Musculus Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:54, pl. 10, figs. 11–12. Holotype USNM 190444, vicinity of Laysan Island, Hawaii. Mytilidae.

leptocharactum, Cerithium (*Thericium*) Rehder, 1980. Smithsonian Contributions to Zoology 289:38, pl. 6, figs. 5–7. Holotype USNM 756335, Hanga Piko, Easter Island. Cerithiidae.

leucathema, Triphora Rehder, 1980. Smithsonian Contributions to Zoology 289:42, pl. 6, fig. 12. Holotype USNM 756003, Hanga Papara, Easter Island. Triphoridae.

leviuscula, Fulgoraria (*Fulgoraria*) Rehder, 1969. Venus, The Japanese Journal of Malacology 27(4):128, pl. 7, figs. 1–4. Holotype USNM 231770, NW of Tung-sha-Tao (Pratas Island), South China Sea. Volutidae.

limitaris, Iniforis Rehder, 1980. Smithsonian Contributions to Zoology 289:41, pl. 6, fig. 10. Holotype USNM 756215, Onetea, Hoituiti, Easter Island. Triphoridae.

lirellata, Nerita (*Heminerita*) Rehder, 1980. Smithsonian Contributions to Zoology 289:23, pl. 4, figs. 14–15. Holotype USNM 756795, Hanga Omiti, Easter Island. Neritidae.

livida, Sayella Rehder, 1935. The Nautilus 48(4):129, pl. 7, fig. 7. Holotype USNM 125556, Corpus Christi Bay, Texas. Pyramidellidae.

loisae, Aeneator (*Ellicea*) Rehder, 1971. Proceedings of the Biological Society of Washington 83(51):593, figs. 7–8. Holotype USNM 701667, type locality not indicated [NW of Valparaiso, Chile]. Buccinulidae.

loisae, Austroharpa Rehder, 1973. Indo-Pacific Mollusca 3(16):264, pl. 237, figs. 3, 6. Holotype WAM 156–72, NW of Rottnest Island, Western Australia. Harpidae.

loisae, Euplica Rehder, 1980. Smithsonian Contributions to Zoology 289:77, pl. 10, figs. 6–8. Holotype USNM 753940, Haka Ea, Vaihu, Easter Island. Columbellidae.

loisae, Triphora Rehder, 1980. Smithsonian Contributions to Zoology 289:44, pl. 6, fig. 14. Holotype USNM 756778, Hanga Papara, Easter Island. Triphoridae.

longinqua, Merelina (*Merelina*) Rehder, 1980. Smithsonian Contributions to Zoology 289:29, pl. 5, fig. 10. Holotype USNM 766829, Onetea, Hotuiti, Easter Island. Rissoidae.

lucasana, Lyonsia (*Phlyctiderma*) Bartsch and Rehder, 1939. Smithsonian Miscellaneous Collections 98(10):12, pl. 4, figs. 1–3. Holotype USNM 472526, off Punta Gorda, Cape San Lucas, Lower California, Mexico. Lyonsiidae.

lutea, Anisodonta Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:124, pl. 34, figs. 7–

10. Holotype USNM 337468, a Honolulu beach, Oahu, Hawaii. Sportellidae.

magdalenensis, Conus Bartsch and Rehder, 1939. Smithsonian Miscellaneous Collections 98(10):4, pl. 1, figs. 5, 9. Holotype USNM 472521, Magdalena Bay, Lower California, Mexico. Conidae.

marielae, Conus Rehder and Wilson, 1975. Smithsonian Contributions to Zoology 203:14, text-fig. 10, frontispiece figs. 10–11. Holotype USNM 703255, off Baie Motu-Hee, Nuku Hiva, Marquesas Islands. Conidae.

mauia, Cadella Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:197, pl. 50, figs. 1–4. Holotype USNM 337347, off Launiupoko, Maui, Hawaii. Tellinidae.

mauia, Glycymeris Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:38, pl. 6, figs. 5–6. Holotype USNM 337443, off Mala Bay, Maui, Hawaii. Glycymeridiidae.

mauia, Navicula Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:12, text-fig. 2, pl. 1, figs. 1–4. Holotype USNM 190446, Aleunihana Channel, Hawaii. Arcidae.

maunaluana, Calloarca (*Barbarca*) Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153: 26, pl. 4, figs. 9–12. Holotype USNM 427757, near Koko Head, Maunalua Bay, Oahu, Hawaii. Arcidae.

mayaorum, Drymaeus Rehder, 1966. Proceedings of the Biological Society of Washington 79:287, figs. 3–4. Holotype USNM 251656, Isla Mujeres, Quintana Roo, Mexico. Orthalicidae.

mediopacificensis, Dentalium Rehder and Ladd, 1973. Science Reports of the Tohoku University (ser. 2, Geology), Special volume 6:48, pl. 3, figs. 1–2. Holotype USNM 703273, Agassiz Guyot, Mid-Pacific Mountains, central Pacific Ocean. Dentaliidae.

mesoleuca, Crassispira (*Crassispirella*) Rehder, 1943. Proceedings of the United States National Museum 93(3161):202, pl. 20, fig. 15. Holotype USNM 411906, Looe Key Reef, Florida. Turridae.

mighelsi, Margarites Rehder, 1937. Proceedings of the Biological Society of Washington 50:115. Replacement name for *Margarites johnsoni* Dall, 1921, preoccupied by *Margarita johnsoni* Arnold, 1909. Trochidae.

milleri, Teredo (*Cornuteredo*) Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:210, pl. 54, figs. 1–2. New name for *Teredo affinis* Deshayes, 1863, as described and figured by Miller, 1924. Dall, Bartsch and Rehder comment that they have not seen this species, and apply their new name to Miller's description, which they believed to be different from *Teredo affinis* Deshayes, 1863. The holotype of *Teredo milleri* (CAS 12384) is the specimen designated as the neotype of *Teredo affinis* Deshayes, 1863 by Moll, 1941 [Turner, 1966:111]. *Teredo milleri* Dall, Bartsch and Rehder, 1938, is therefore a junior objective synonym of *Teredo affinis* Deshayes, 1863, now placed in the genus *Lyrodus* [Turner, 1966:86]. Teredinidae.

miltoplax, Chiton Rehder, 1932. The Nautilus 45(4):pl. 10, figs. 4–5. Nomen nudum.

mimula, Dimya Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:78, pl. 19, figs. 1–2. Holotype USNM 173002, off south coast of Molokai, Hawaii. Dimyidae.

mimus, Spondylus Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:102, pl. 26, figs. 6–7. Holotype USNM 337509, entrance to Honolulu Harbor, Oahu, Hawaii. Spondylidae.

molokaia, Barbatia (*Abarbatia*) Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:32, text-fig. 11, pl. 5, figs. 7–10. Holotype USNM 173203, off south coast of Molokai, Hawaii. Arcidae.

molokaia, Dimya Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:79, pl. 19, fig. 3. Holotype USNM 190431, off north coast of Molokai, Hawaii. Dimyidae.

molokaia, Glycymeris Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:35, pl. 6, figs. 1–2. Holotype USNM 427761, off south coast of Molokai, Hawaii. Glycymeridiidae.

molokaium, Propeamussium Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:82, pl. 20, fig. 8, pl. 21, figs. 5–6. Holotype USNM 335677, off south coast of Molokai, Hawaii. Propeamussiidae.

molokaius, Musculus Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:53, pl. 10, figs. 5–6. Holotype USNM 190445, off south coast of Molokai, Hawaii. Mytilidae.

monilis, Monilispira Bartsch and Rehder, 1939. Proceedings of the United States National Museum 87(3070):137, pl. 17, fig. 10. Holotype USNM 508649, Waveland, Dade County, Florida. Turridae.

morrisoni, Microdaphne Rehder, 1980. Smithsonian Contributions to Zoology 289:88, text-fig. 12, pl. 11, figs. 5–6. Holotype USNM 758390, Motu Mataira, Raroia, Tuamotu Islands. Turridae.

mozambicana, Volutocorbis Rehder, 1972. The Veliger 15(1):12, figs. 3–5, 7–9. Holotype USNM 717909, 95 miles SE of Inhaca Id., Mozambique. Volutidae.

muricl, Anabathron Bartsch and Rehder, 1939. The Nautilus 52(4):110, pl. 8, figs. 2, 2a. Holotype USNM 535345, Ogliuga Island, Aleutian Islands. Barleeidae.

nana, Volutocorbis Rehder, 1974. The Nautilus 88(2):35. figs. 1–4. Holotype USNM 709351, off coast of southern Zululand, Natal. Volutidae.

nebulosum, Fartulum Rehder, 1943. Proceedings of the

United States National Museum 93(3161):190, pl. 20, fig. 8. Holotype USNM 536042, Bonefish Key, Florida. Type locality corrected (The Nautilus 57(1):32) to Missouri Key, 14 or 15 miles west of Bonefish Key. Caecidae.

nebulosus, Semelangulus Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:180, pl. 47, figs. 5–8. Holotype USNM 484202, off Launiupoko, Maui, Hawaii. Tellinidae.

nesiotum, Propeamussium Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:81, pl. 19, figs. 12–15, pl. 20 fig. 7. Holotype USNM 190441, off south coast of Molokai, Hawaii. Propeamussiidae.

newcombi, Volsella (*Amygdalum*) Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:45, pl. 8, figs. 9–10. Holotype USNM 173022, off south coast of Oahu, Hawaii. Mytilidae.

nigrescens, Alvania Bartsch and Rehder, 1939. Smithsonian Miscellaneous Collections 98(10):8, pl. 2, fig. 5. Holotype USNM 472621, Old Providence Island, Colombia [Caribbean]. Rissoidae.

nigrita, Synaptocochlea Rehder, 1939. The Nautilus 53(1):20, pl. 6, fig. 1. Holotype USNM 473205, Loggerhead Key, Dry Tortugas Keys, Florida. Stomatellidae.

notabilis, Adrana Rehder, 1939. The Nautilus 53(1):16, pl. 6, figs. 4, 12. Holotype USNM 499337, Paraguana Peninsula, Venezuela. Nuculanidae.

nucella, Pinguitellina Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:195, text-fig. 28, pl. 49, figs. 9–12. Holotype USNM 484199, off Lihau, Maui, Hawaii. Tellinidae.

nuttingi, Calloarca (*Barbarca*) Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:26, pl. 4, figs. 17–20. Holotype USNM 335648, Laysan Island, Hawaii. Arcidae.

nux, Glycymeris Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:36, pl. 6, figs. 9–12. Holotype USNM 173003, Pailolo Channel, Hawaii. Glycymeridae.

oahua, Barbatia (*Abarbatia*) Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:30, text-fig. 10, pl. 5, figs. 1–4. Holotype USNM 427767, Kaneohe Bay, Oahu, Hawaii. Arcidae.

oahua, Glycymeris Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:39, pl. 7, figs. 10–11. Holotype USNM 338229, off south coast of Oahu, Hawaii. Glycymeridae.

oahua, Pinna Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:75, pl. 18, figs. 5–6. Holotype USNM 337506, type locality not stated. Pinnidae.

oahuana, Cadella Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:197, pl. 50, figs. 5–8. Holotype USNM 333069, near Koko Head, Oahu, Hawaii. Tellinidae.

oahuana, Rocellaria Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:201, pl. 51, figs. 6–10. Holotype USNM 337314, off Waikiki, Oahu, Hawaii. Gastrochaenidae.

oahuensis, Lyonsia (*Allogramma*) Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153: 215, pl. 56, figs. 9–12. Holotype USNM 173017, Pailolo Channel, Hawaii. Lyonsiidae.

oahuensis, Semelangulus Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:181, pl. 47, figs. 9–12. Holotype USNM 337346, entrance to Honolulu Harbor, Oahu, Hawaii. Tellinidae.

oahuus, Musculus Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:54, pl. 10, figs. 13–14. Holotype USNM 484181, Pearl Harbor, Oahu, Hawaii. Mytilidae.

ochrostigmata, Natica Rehder, 1980. Smithsonian Contributions to Zoology 289:64, pl. 8, figs. 13–15. Holotype USNM 339159, off Launiupoko, Maui, Hawaii. Naticidae.

orinus, Nacsiotus quitensis Rehder, 1940. The Nautilus 53(4):116, pl. 13, figs. 6, 10. Holotype USNM 473971, Chimborazo (near Riobamba), Ecuador. Orthalicidae.

ovalis, Hitia Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:136, text-fig. 15, pl. 37, figs. 1–4. Holotype USNM 21120, "Sandwich Islands" [Hawaii]. Sportellidae.

pacifica, Tenua Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:58, pl. 11, figs. 11–14. Holotype USNM 173020, off south coast of Oahu, Hawaii. Mytillidae.

pailoloana, Cuspidaria (*Myonera*) Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153: 225, pl. 58, figs. 8–11. Holotype USNM 173015, Pailolo Channel, Hawaii. Cuspidariidae.

pailoloum, Propeamussium Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:82, pl. 19, figs. 8–11, pl. 20, figs. 5–6. Holotype USNM 173209, Pailolo Channel, Hawaii. Propeamussiidae.

pailolous, Musculus Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:55, pl. 10, figs. 7–10. Holotype USNM 335310 [incorrectly published as 335301], Napili Harbor, Maui, Hawaii. Mytilidae.

palmeri, Humboldtiana Clench and Rehder, 1930. The Nautilus 44(1):12, pl. 2, figs. 1–4. Holotype MCZ 79779, Jeff Davis County, Texas. Helminthoglyptidae.

parallela, Lima Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:106, pl. 27, figs. 9–12. Holotype USNM 333074, off Lahaina, Maui, Hawaii. Limidae.

parvispinus, Spondylus Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:99, pl. 25, figs. 5–8. Holotype USNM 484161, Honaunau, Hawaii. Spondylidae.

pascua, Siphonaria Rehder, 1980. Smithsonian Contributions to Zoology 289:97, pl. 12, figs. 4–7. Holotype CAS 58706, Easter Island. Siphonariidae.

pascuana, Granula Rehder, 1980. Smithsonian Contributions to Zoology 289:85, pl. 9, fig. 20. Holotype USNM 710721, Onetea, Hotuiti, Easter Island. Cystiscidae.

pascuensis, Conus miliaris Rehder, 1980. Smithsonian Contributions to Zoology 289:91, pl. 9, figs. 21–22. Holotype USNM 766496, Hanga Piko, Easter Island. Conidae.

pauliseulpta, Spiraxis (Rectaxis) Rehder, 1942. Journal of the Washington Academy of Sciences 32(11):350, fig. 18. Holotype USNM 536016, Santa Maria, San Jose Province, Costa Rica. Spiraxidae.

perductorum, Drymaeus Rehder, 1943. The Nautilus 57(1):29, pl. 6, figs. 6–9. Holotype USNM 517552, near Las Grutas de Cacahuamilpa, Guerrero, Mexico. Orthalicidae.

peregrina, Polygyra Rehder, 1932. The Nautilus 45(4): 130, text-fig. 1. Holotype MCZ 81349, Izard County Arkansas. Polygyridae.

perryae, Cerodrillia (Cerodrillia) Bartsch and Rehder, 1939. Proceedings of the United States National Museum 87(3070):128, pl. 17, fig. 1. Holotype USNM 508644, Sanibel Island, Florida. Turridae.

perryae, Kurtziella Bartsch and Rehder, 1939. Proceedings of the United States National Museum 87(3070): 134, pl. 17, figs. 7, 9. Holotype USNM 508646, Sanibel Island, Florida. Turridae.

philippii, Peronaeus Rehder, 1945. Revista Chilean de Historia Natural, 48(1944):3. Holotype USNM 537830, near Copiapo, Chile. Orthalicidae.

pilsbryi, Dentalium (Antalis) Rehder, 1942. The Nautilus 56(2):69. Replacement name for *Dentalium (Antalis) pseudohexagonum* "Ihering" Henderson, 1920, preoccupied by *Dentalium pseudohexagonum* Arnold, 1903. Dentaliidae.

pilsbryi, Megaspira Rehder, 1945. The Nautilus 59(2): 67. New name for *Megaspira elata* (Gould) Pilsbry, 1904, not *Megaspira elata* Gould, 1847. Three syntypes are enumerated, ANSP 3057, ANSP 25041, USNM, number not published. Brazil. Megaspiridae.

pilsbryi, Privigna Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:161, pl. 42, figs. 9–12. Holotype USNM 484192, Pearl Harbor, Oahu, Hawaii. Veneridae.

pilsbryi, Rotadiscus Rehder, 1942. Journal of the Washington Academy of Sciences 32(11):352, figs. 10–12. Holotype USNM 536018, Santa Maria, San Jose Province, Costa Rica. Charopidae.

pilula, Pitar (Nanopitar) Rehder, 1943. Proceedings of the United States National Museum 93(3161):188, pl. 19, figs. 5–10. Holotype USNM 517057, Lake Worth, Florida. Veneridae.

pisinna, Melanella Rehder, 1980. Smithsonian Contributions to Zoology 289:54, pl. 7, figs. 10–11. Holotype USNM 756117, Haka Ea, Vaihu, Easter Island. Eulimidae.

pisum, Bathyarca Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:19, text-fig. 6, pl. 3, figs. 1–4. Holotype USNM 335684, Pailolo Channel, Hawaii. Arcidae.

planospira, Spiratella Rehder, 1942. United States Department of the Interior, Geological Survey, Professional Paper 196-D:108, pl. 23, figs. 5–7. Holotype USNM 535416, 49°36′N 28°54′W, middle of North Atlantic Ocean (sample H-63, core 8). Limacinidae.

polynesica, Metaxia Rehder, 1980. Smithsonian Contributions to Zoology 289:47, pl. 7, fig. 1. Holotype MNSH 200413, Easter Island. Triphoridae.

polynesica, Nucula Rehder, 1980. Smithsonian Contributions to Zoology 289:106, pl. 13, figs. 1–2. Holotype USNM 756244, Onetea, Hotuiti, Easter Island. Nuculidae.

polynesica, Williamia Rehder, 1980. Smithsonian Contributions to Zoology 289:98, pl. 12, figs. 10–11. Holotype USNM 757897, off Waikiki, Oahu, Hawaii. Siphonariidae.

powelli, Comitas Rehder and Ladd, 1973. Science Reports of the Tohoku University (ser. 2, Geology), Special volume 6:45, pl. 3, figs. 11–12. Holotype USNM 703267, Agassiz Guyot, central Pacific Ocean. Turridae.

praecipua, Morula Rehder, 1980. Smithsonian Contributions to Zoology 289:70, pl. 9, fig. 5. Holotype USNM 751592, Hanga Piko, Easter Island. Muridicae.

pratasensis, Sigaluta Rehder, 1967. Pacific Science, 21(2):182, figs. 1–4. Holotype USNM 237618 [incorrectly published as 237018], west of Pratas Reef, South China Sea (20°37′N, 115°43′E). Marginellidae. [junior synonym of *Marginellona gigas* (Martens, 1904) see Harasewych and Kantor, 1991]

pulcher, Halopsephus Rehder, 1943. Proceedings of the United States National Museum 93(3161):191, pl. 20, figs. 3, 10. Holotype USNM 500638, off Lazaretto, Barbados. Turbinidae.

pumilio, Peronaeus Rehder, 1945. Revista Chilean de Historia Natural, 48(1944):5. Replacement name for *Bulimus nanus* Reeve, 1849, preoccupied by *Bulimus nanus* Lamarck, 1804. Orthalicidae.

rapanuiensis, Leuconopsis Rehder, 1980. Smithsonian

Contributions to Zoology 289:101, pl. 12, fig. 3. Holotype USNM 756790, Onetea, Hotuiti, Easter Island. Ellobiidae.

recta, Atrina (Atrina) Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:76, pl. 17, figs. 3–4. Holotype USNM 484153, off south coast of Molokai, Hawaii. Pinnidae.

rectangula, Hawaiarca Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:27, text-fig. 9, pl. 3, figs. 11–14. Holotype USNM 173222, Alenuihaha Channel, Hawaii. Arcidae.

riisei, Arene Rehder, 1943. Proceedings of the United States National Museum 93(3161):192, pl. 19, figs. 17–18. Holotype USNM 42858, St. John, Virgin Islands. Turbinidae.

roosevelti, Conus Bartsch and Rehder, 1939. Smithsonian Miscellaneous Collections 98(10):3, pl. 1, figs. 4, 7. Holotype USNM 472854, Clipperton Island, East Pacific Ocean. Conidae.

roosevelti, Marginella Bartsch and Rehder, 1939. Smithsonian Miscellaneous Collections 98(10):5, pl. 1, figs. 2–3. Holotype USNM 472610, Old Providence Island, Colombia [Caribbean]. Marginellidae.

roosevelti, Peasiella Bartsch and Rehder, 1939. Smithsonian Miscellaneous Collections 98(10):8, pl. 2, figs. 1–3. Holotype USNM 472575, Sulivan Bay, James Island, Galapagos Islands. Littorinidae.

roosevelti, Terebra (Subula) Bartsch and Rehder, 1939. Smithsonian Miscellaneous Collections 98(10):1, pl. 1, fig. 6. Holotype USNM 472534, Socorro Island, Mexico. Terebridae.

rosavittoriae, Volutocorbis Rehder, 1981. The Nautilus 95(4):169, figs. 1–5. Holotype USNM 784653, Off Kisimayu, southern Somalia. Volutidae.

rosea, Kaneoha Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:142, text-fig. 19, pl. 39, figs. 9–12. Holotype USNM 484185, Mokuoloe Island, Kaneohe Bay, Oahu, Hawaii. Kelliidae.

rostrata, Poromya Rehder, 1943. Proceedings of the United States National Museum 93(3161):189, pl. 19, figs. 11–12. Holotype USNM 536152, off Delray Beach, Palm Beach County, Florida. Poromyidae.

rostratula, Ervilia Rehder, 1943. Proceedings of the United States National Museum 93(3161):189, pl. 19, figs. 1–2. Holotype USNM 517059, Lake Worth, Florida. Mesodesmatidae.

rubropicta, Chama Bartsch and Rehder, 1939. Smithsonian Miscellaneous Collections 98(10):13, pl. 3, figs. 6–10. Holotype USNM 472553, Clipperton Island, East Pacific Ocean. Chamidae.

radis, Septifer Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:50, pl. 9, figs. 5–8. Holotype USNM 173223, off Alenuihaha Channel, Hawaii. Mytilidae.

ruizana, Limopsis (Felicia) Rehder, 1971. Proceedings of the Biological Society of Washington 83(51):586, fig. 1. Holotype USNM 701671, NW of Valparaiso, Chile. Limopsidae.

sagenaria, Kermia Rehder, 1980. Smithsonian Contributions to Zoology 289:90, pl. 11, fig. 1. Holotype USNM 756115, Haka Ea, Vaihu, Easter Island. Turridae.

sagittatus, Modiolus (Amygdalum) Rehder, 1935. The Nautilus 48(4):127, pl. 7, figs. 11–12. Holotype USNM 93999, off Cape San Blas, Florida. Mytilidae.

sallasi, Murex (Murex) recurvirostris Rehder and Abbott, 1951. Revista de la Sociedad Malacologica "Carlos de la Torre" 8(2):58, pl. 9, figs. 7–8. Holotype USNM 597515, NW of Cape Catoche, Quintana Roo, Mexico. Muricidae.

sanibelensis, Crassispira (Crassispirella) Bartsch and Rehder, 1939. Proceedings of the United States National Museum 87(3070):135, pl. 17, figs. 11–12. Holotype USNM 508647, Sanibel Island, Florida. Turridae.

sanibelensis, Succinea Rehder, 1933. The Nautilus 47(1): 20. Holotype MCZ 59645, Sanibel Island, Florida. Succineidae.

scaphoides, Adrana Rehder, 1939. The Nautilus 53(1): 17, pl. 6, fig. 5. Holotype USNM 364223, near Cartagena, Colombia. Nuculanidae.

schefferi, Liocyma Bartsch and Rehder, 1939. The Nautilus 52(4):111, pl. 8, figs. 1–1b. Holotype USNM 535344, off Chuginadak Island, Aleutian Islands, Alaska. Veneridae.

schmitti, Littorina Bartsch and Rehder, 1939. Smithsonian Miscellaneous Collections 98(10):9, pl. 2, fig. 4. Holotype USNM 472547, Clipperton Island, East Pacific Ocean. Littorinidae.

schroederi, Cerodrillia (Lisodrillia) Bartsch and Rehder, 1939. Proceedings of the United States National Museum 87(3070):130, pl. 17, fig. 8. Holotype USNM 530585, off Charlotte Harbor, Florida. Turridae.

semirugata, Volutocorbis Rehder and Weaver, 1974. The Nautilus 88(2):31, figs. 1–8. Holotype NM 9939, SE of Bluff, Durban, South Africa. Type catalog number and locality corrected [The Nautilus 89(3):79] to NM Moll. no. G769, off Ilha Bazaruto, Mozambique. Volutidae.

sennottorum, Conus Rehder and Abbott, 1951. Revista de la Sociedad Malacologica "Carlos de la Torre" 8(2): 63, pl. 9, figs. 1–2. Holotype USNM 597519, SW of Campeche, Yucatan, Mexico. Conidae.

serratissimus, Spondylus Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:97, pl. 25, figs. 9–12. Holotype USNM 337513, off Honolulu, Oahu, Hawaii. Spondylidae.

significans, Bartschia Rehder, 1943. Proceedings of the United States National Museum 93(3161):199, pl. 20, fig. 17. Holotype USNM 516493, off Tortugas, Florida. Buccinidae.

smirna, Conus Bartsch and Rehder, 1943. Proceedings of the Biological Society of Washington 56:87. Holotype USNM 173226, near Kauai Island, Hawaii. Conidae.

sparsipunctata, Psarostola monilifera Rehder, 1943. Proceedings of the United States National Museum 93(3161):198, pl. 20, fig. 11. Holotype USNM 450778, southeast of Fowey Light, Florida. Columbellidae.

sparsispinosus, Spondylus Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:98, pl. 26, figs. 1–5. Holotype USNM 190436, Pailolo Channel, Hawaii. Spondylidae.

spiceri, Comptopallium Rehder, 1944. The Nautilus 58(2):52, pl. 2, figs. 1–2. Holotype USNM 518010, Christmas Island, Line Islands, Central Pacific. Pectinidae.

spiceri, Conus Bartsch and Rehder, 1943. Proceedings of the Biological Society of Washington 56:87. Holotype USNM 537792, Sand Island, Midway, Central Pacific. Conidae.

springeri, Anadara Rehder and Abbott, 1951. Revista de la Sociedad Malacologica "Carlos de la Torre" 8(2):54, pl. 8, figs. 8–9. Holotype USNM 597375, off Dry Tortugas, Florida. Arcidae.

stearnsi, Chlamys Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:89, pl. 22, figs. 11–12. Holotype USNM 495030, Waianae Quarry, Oahu, Hawaii. Pectinidae.

tampaensis, Crassispira (*Crassispirella*) Bartsch and Rehder, 1939. Proceedings of the United States National Museum 87(3070):136, pl. 17, figs. 5, 13. Holotype USNM 493409, Tampa Bay, Florida. Turridae.

tedbayeri, Natica (*Glyphepithema*) Rehder, 1986. The Nautilus 100(3):112. Replacement name for *Natica* (*Glyphepithema*) *bayeri* Rehder, 1986, preoccupied by *Natica* (*Naticina*) *bayeri* Koperberg, 1931. See *bayeri, Natica* Rehder, 1986. Naticidae.

terryae, Helicina Rehder, 1942. Journal of the Washington Academy of Sciences 32(11):350, fig. 16. Holotype USNM 536026 [incorrectly published as 539026], Chiriqui Province, Republic of Panama. Helicinidae.

thaanumi, Arcinella Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:117, pl. 33, figs. 1–4. Holotype USNM 484176, near Koko Head, Oahu, Hawaii. Chamidae.

thaanumi, Mactra Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:172, pl. 44, figs. 1–4. Holotype USNM 337324, off Kaanapali, Maui, Hawaii. Mactridae.

thaanumi, Mirapecten Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:84, pl. 21, figs. 7–8. Holotype USNM 173195, off south coast of Molokai, Hawaii. Pectinidae.

thaanumi, Ostrea Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:114, pl. 32, figs. 1–4. Holotype USNM 484158, Mokuoloe Island, Kaneohe Bay, Oahu, Hawaii. Ostreidae.

thurstoni, Fragum Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:154, pl. 41, figs. 9–10. Holotype USNM 484189, Keokea, Hilo, Hawaii. Cardiidae.

tita, Semele Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:177, pl. 45, figs. 1–4. Holotype USNM 484197, Keaukaha, Hilo, Hawaii. Semelidae.

torrei, Acteon Aguayo and Redher, 1936. Memorias de la Sociedad Cubana de Historia Natural 9(4):268, pl. 24, fig. 8. Holotype USNM 420977, La Chorrera, Habana, Cuba. Acteonidae.

transversa, Ctena Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:131, pl. 35 figs. 9–12. Holotype USNM 337409, off Waikiki, Oahu, Hawaii. Lucinidae.

transversa, Poromya Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:224, pl. 57, figs. 5–6. Holotype USNM 333017 [incorrectly published as 330317], off south coast of Molokai, Hawaii. Poromyidae.

transversum, Microcardium Rehder and Abbott, 1951. Revista de la Sociedad Malacologica "Carlos de la Torre" 8(2):56, pl. 9, figs. 9–10. Holotype USNM 485739 [incorrectly published as 485734], SSW of Marsh Island, Iberia County, Louisiana. Cardiidae.

valerioi, Streptostyla (*Streptostyla*) Rehder, 1942. Journal of the Washington Academy of Sciences 32(11):351, fig. 17. Holotype USNM 536020, Cervantes, Cartago Province, Costa Rica. Spiraxidae.

vanhyningi, Arene Rehder, 1943. Proceedings of the United States National Museum 93(3161):192, pl. 19, figs. 15–16. Holotype USNM 536054, Sand Key, 8 miles south of Key West, Florida. Turbinidae.

vanhyningi, Conus verrucosus Rehder, 1944. The Nautilus 57(3):106. Holotype USNM 537863, on beach off Pompano, Broward County, Florida. Conidae.

vanhyningi, Cumingia tellinoides Rehder, 1939. The Nautilus 53(1):19, pl. 6, figs. 13–14. Holotype USNM 473123, Lower Matecumbe Key, Florida. Semelidae.

vargasi, Triphora Rehder, 1980. Smithsonian Contributions to Zoology 289:43, pl. 6, fig. 11. Holotype MNSH 200384, Easter Island. Triphoridae.

vaughani, Septifer Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:50, pl. 9, figs.

9–10. Holotype USNM 495045, Wailupe Quarry, Oahu, Hawaii. Mytilidae.

velascoi, Emarginula Rehder, 1980. Smithsonian Contributions to Zoology 289:16, pl. 4, figs. 2–3. Holotype USNM 756019, Hanga Papara, Easter Island. Fissurellidae.

venustula, Arene Aguayo and Redher, 1936. Memorias de la Sociedad Cubana de Historia Natural 9(4):264, pl. 24, figs. 1–3. Holotype USNM 420976, La Chorrera, Habana, Cuba. Turbinidae.

venustulus, Chicoreus (*Chicomurex*) Rehder and Wilson, 1975. Smithsonian Contributions to Zoology 203:7, text-figs. 4–5, frontispiece figs. 2–3. Holotype USNM 707241, off SW coast of Tahuata, Marquesas Islands. Muricidae.

verae, Naticarius Rehder, 1947. The Nautilus 61(1):19, pl. 1, top figure. Holotype USNM 485562, Marco Beach, Marco Island, Collier County, Florida. Naticidae.

vermiculatus, Naesiotus quitensis Rehder, 1940. The Nautilus 53(4):117, pl. 13, figs. 17, 19. Holotype MCZ 64957, Agoyan (near Baños Tunguragua), Ecuador. Orthalicidae.

vestalis, Crepitacella Rehder, 1943. Proceedings of the United States National Museum 93(3161):194, pl. 20, fig. 13. Holotype USNM 411896, off Ajax Reef, Florida. Rissoidae.

vetula, Arca Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:17, text-fig. 5, pl. 2, figs. 1–2, 5–6. Holotype USNM 495025, near Kaelepulu Pond, Oahu, Hawaii. Arcidae.

vitrea, Dysmea Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:174, pl. 44, figs. 13–14. Holotype USNM 173001, off south coast of Molokai, Hawaii. Psammobiidae.

waikikia, Limopsis Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:42, text-fig. 13, pl. 7, fig. 1. Holotype USNM 484219, off Waikiki, Oahu, Hawaii. Limopsidae.

waikikius, Pecten Dall, Bartsch and Rehder, 1938. Bernice P. Bishop Museum Bulletin 153:95, pl. 24, figs. 5–6. Holotype USNM 337523, off Waikiki, Oahu, Hawaii. Pectinidae.

wareni, Vitreolina Rehder, 1980. Smithsonian Contributions to Zoology 289:56, pl. 7, figs. 14–15. Holotype CAS 59676, Easter Island. Eulimidae.

williamsorum, Teramachia johnsoni Rehder, 1972. The Veliger 15(1):8, figs. 1–2, 4. Holotype USNM 707229, 30 miles south of Tung-Chiang, Taiwan. Volutidae.

wilsoni, Austroharpa Rehder, 1973. Indo-Pacific Mollusca 3(16):267, pl. 237, figs. 1–2. Holotype WAM 3670, NW of Rottnest Island, off Perth, Western Australia. Harpidae.

III. PUBLICATIONS OF HARALD A. REHDER

Harald A. Rehder authored 169 research papers and books over a span of 70 years (1924–1993). His first and last papers were in *The Nautilus*, a journal in which he published 55 articles. Dr. Rehder published in a broad spectrum of journals and molluscan newsletters on a wide variety of topics and taxa. While he came to be recognized as a gastropod systematist with a special interest in the families Harpidae (6 publications) and Volutidae (11 papers), Rehder began his career studying land and freshwater gastropods (20 publications). He also published on Polyplacophora, Bivalvia, Scaphopoda, and Cephalopoda, describing new taxa in each of these molluscan classes. Dr. Rehder devoted 35 publications to documenting the molluscan fauna of the tropical Pacific, and 44 papers to nomenclatural and bibliographic issues.

The following list of publications is arranged in chronological order, with dates of publication provided in square brackets [ ] when they could be determined. Dates of papers published in *The Nautilus* are from Coan and Harasewych (1993). Publications of the United States National Museum are dated according to Anonymous (1971).

Rehder, H. A. 1924 [15 January]. A list of mollusks from Intervale, N.H. [New Hampshire]. The Nautilus 37(3): 96–97.

Clench, W. J. and H. A. Rehder. 1930 [17 July]. A new *Humboldtiana* from Texas. The Nautilus 44(1):10–13, pl. 2, figs. 1–4.

Rehder, H. A. 1932a [9 April]. Two new Polygyras from northern Arkansas. The Nautilus 45(4):128–131, text-figs. 1–2, pl. 10.

Rehder, H. A. 1932b [9 April]. *Polygyra kiowaensis*. The Nautilus 45(4):141.

Rehder, H. A. 1933 [16 June]. A new *Succinea* from Florida. The Nautilus 47(1):20–21, pl. 3, fig. 4.

Rehder, H. A. 1935 [24 April]. New Caribbean marine shells. The Nautilus 48(4):127–130, pl. 7, figs. 7–12.

Rehder, H. A. 1936 [30 January]. The type of *Polygyra* Say. The Nautilus 49(3):102–103.

Aguayo, C. G. and H. A. Rehder. 1936 [13 January]. New marine mollusks from Cuba. Memorias de la Sociedad Cubana de Historia Natural 9(4):263–268, pl. 24, figs. 1–8.

Rehder, H. A. 1937a [4 May]. The type of *Amicula* Gray. The Nautilus 50(4):142.

Rehder, H. A. 1937b [4 May]. *Congeria leucophacata* (Con.) in the Hudson River. The Nautilus 50(4):143.

Rehder, H. A. 1937c [3 July]. *Rissoa bermudezi* Aguayo and Rehder. The Nautilus 51(1):35–36.

Rehder, H. A. 1937d [7 August]. Notes on the nomen-

clature of the Trochidae. Proceedings of the Biological Society of Washington 50:115–116.

Rehder, H. A. 1937e [23 September]. The genus *Xymorus* Gebler. The Journal of Conchology (London) 20(12):370.

Dall, W. H., P. Bartsch and H. A. Rehder. 1938. [25 July] A manual of Recent and fossil marine pelecypod mollusks of the Hawaiian Islands. Bernice P. Bishop Museum Bulletin 153:1–233, pls. 1–58.

Rehder, H. A. 1939a [15 April]. A new *Nenia* from Haiti and some notes on this genus. Journal of the Washington Academy of Science 29(4):171–173, figs. 1–7.

Bartsch, P. and H. A. Rehder. 1939a [26 April]. Two new marine shells from the Aleutian Islands. The Nautilus 52(4):110–112, pl. 8, figs. 1–2.

Bartsch, P. and H. A. Rehder. 1939b [13 June]. Mollusks collected on the Presidential Cruise of 1938. Smithsonian Miscellaneous Collections 98(10):1–18, pls. 1–5.

Rehder, H. A. 1939b [21 July]. New marine mollusks from the West Atlantic. The Nautilus 53(1):16–21, pl. 6, figs. 1–14.

Rehder, H. A. 1939c [21 July]. *Microdenclus* versus *Gibbium*. The Nautilus 53(1):33–34.

Rehder, H. A. 1939d [September]. Review of: Lichtig, Ignaz.1938. Die Enstehung des Lebens durch stetige Schöpfung (The origin of life by constant creation), Noord-Hollandsche Uitgeners Maatschappij, Amsterdam. Journal of Paleontology 13(5):539–541.

Bartsch, P. and H. A. Rehder. 1939c [15 September]. New turrid mollusks from Florida. Proceedings of the United States National Museum 87(3070):127–138, pl. 17, figs. 1–13.

Rehder, H. A. 1940a [29 April]. New mollusks of the genus *Naesiotus* from Ecuador. The Nautilus 53(4):111–118, pl. 13, figs. 1–20.

Bartsch, P. and H. A. Rehder. 1940 [29 April]. *Phlycticoncha*, new name for a subgenus of *Lyonsia*. The Nautilus 53(4):137.

Rehder, H. A. 1940b [28 June]. On the molluscan genus *Trimusculus* Schmidt 1818, with notes on some Mediterranean and West African Siphonarias. Proceedings of the Biological Society of Washington 53:67–69.

Rehder, H. A. 1940c [15 July]. A new urocoptid mollusk from Mexico. Journal of the Washington Academy of Science 30(7):315–316, figs. 1–3.

Rehder, H. A. 1940d [2 November]. *Hyaloteuthis pelagicus* (Bosc) in the North Pacific. The Nautilus 54(2):71–72.

Rehder, H. A. 1940e [2 November]. Note on *Thericium auricoma* Schwengel and *stantoni* Dall. The Nautilus 54(2):72–73.

Rehder, H. A. 1941a [5 May]. The type of *Neptunea* "Bolten" Röding [in part]. The Nautilus 54(4):126.

Rehder, H. A. 1941b [5 May]. *Myrsus* H. and A. Adams 1858, the valid name for *Apolymetis* Salisbury 1929. The Nautilus 54(4):141–142.

Rehder, H. A. 1941c [24 October]. Correction *re Myrsus* and *Apolymetis*. The Nautilus 55(2):64–65.

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Rehder, H. A. 1942b [May]. Geology and biology of North Atlantic deep-sea cores between Newfoundland and Ireland. Part 5, Mollusca. United States Department of the Interior, Geological Survey, Professional Paper 196-D:107–109, 1 pl. 9 figures

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Rehder, H. A. 1943c [23 July]. Two new species of *Drymaeus* from Mexico. The Nautilus 57(1):28–29, pl. 6, figs. 6–10.

Rehder, H. A. 1943d [23 July]. Corrections and ecological notes on some recently described Florida marine shells. The Nautilus 57(1):32–33.

Bartsch, P. and H. A. Rehder. 1943a [1 October]. New cones from the Hawaiian Islands. Proceedings of the Biological Society of Washington 56:85–88.

Bartsch, P. and H. A. Rehder. 1943b [30 October]. Notes on the names *Poteria*, *Ptychocochlis*, and *Aperostoma*. The Nautilus 57(2):62–64.

Rehder, H. A. 1944a [9 February]. A new *Vitrinella* from Maryland. The Nautilus 57(3):97, pl. 9, figs. 1–2.

Rehder, H. A. 1944b [9 February]. *Conus verrucosus vanhyningi*, new subspecies. The Nautilus 57(3):106.

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Rehder, H. A. 1947c [14 July]. *Cepaea nemoralis* in Boston. The Nautilus 61(1):35.

Rehder, H. A. 1947d [18 December]. *Arion ater* (L.) in Oregon. The Nautilus 61(2):70.

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Rehder, H. A. 1951a [9 October]. Comments and list of modern names, pp. 486–503. *In:* A. Julia Rogers. The Shell Book; a Popular Guide to a Knowledge of the Families of Living Mollusks, and an Aid to the Identification of Shells Native and Foreign. Revised edition, Boston: C.T. Branford, xxi + 503 pages, 8 pls.

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Rehder, H. A. 1964 [May]. Marine mollusks of Polynesia—a research project. Hawaiian Shell News 12(7):6–7.

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At the time of his death, Dr. Rehder was working on a paper recounting the history of the Division of Mollusks at the National Museum of Natural History, Smithsonian Institution.

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In Memoriam

Constance E. Boone

December 3, 1917

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September 13, 1999

Notices

THE R. T. ABBOTT VISITING CURATORSHIP

The Bailey-Matthews Shell Museum is pleased to invite applications for the 2000 R. T. Abbott Visiting Curatorship.

The curatorship, established originally in accordance with the wishes of the late Dr. R. T. Abbott, Founding Director of the Shell Museum, is awarded annually to enable mollusk systematists to visit the museum for a period of one to two weeks. Abbott Fellows will be expected, by performing collection-based research, to assist with the curation of the portions of the museum's Mollusk Collection and to provide one evening talk for the general public. The museum collection consists of marine, freshwater, and land shells, with emphasis on SW Florida. A large percentage of the records has been catalogued through a computerized database management system. A substantial portion of the time will be available for research in the museum collection, but field work in SW Florida can be arranged. The R. T. Abbott Visiting Curatorship is accompanied by a stipend of $1,500.

Interested malacologists are invited to send a copy of their curriculum vitae togeather with a letter detailing their areas of taxonomic expertise and research objectives, and to provide a tentative title for their talk.
Send materials to:

Dr. José H. Leal, Director
The Bailey-Matthews Shell Museum
P. O. Box 1580
Sanibel, FL 33957

Applications for the 2000 Visiting Curatorship should be sent no later than January 31, 2000. The award will be announced by February 28, 2000. Questions about the R. T. Abbott Visiting Curatorship should be directed to Dr. Leal at:

(941) 395-2233; fax (941) 395-6706, or e-mail: jleal@gate.net

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